THE MARKET POTENTIAL OF LOCAL AREA NETWORKS IN HONG KONG

by

CHAN KWOK-SUM
陳國森
MAK WAI-SING
麥偉成

RESEARCH REPORT

Presented to

The Graduate School

In Partial Fulfilment

of the Requirements for the Degree of

MASTER OF BUSINESS ADMINISTRATION

TWO-YEAR MBA PROGRAMME

THE CHINESE UNIVERSITY OF HONG KONG

MAY 1986

(DR. Y. T. FUNG)

Advisor

ACKNOWLEDGEMENTS

We would like to take this opportunity to thank our advisor, Dr. Y. T. Fung, for his invaluable assistance and guidance throughout the project.

We owe a debt of gratitude to Mr. Richard Cheung of Hong Kong Management Association. He helped us in preparing a random sample of the EDP managers listed in the HKMA database. This list was an important part for our questionnaire survey.

Thanks should also go to our respondents: Mr. M. T. Au of Hong Kong Electric, Mr. Y. W. Ho of Hong Kong Air Cargo Terminal Ltd., Mr. Ivan Lee of Compac Microelectronics (HK) Ltd., Mr. Alex Chu of Daw Computer Systems Ltd., Mr. Eddie Chang of Convergent Microsystem (HK) Ltd. and Mr. A. Yue of Datalink Computer Systems Ltd. for providing the writers useful information and valuable insight into the research problem.

ABSTRACT

Nowadays, personal computers have become more and more important in the business environment of Hong Kong. However, people have experienced some problems with these stand-alone personal computers. Sharing of common data and expensive peripherals are not possible. The need of communicating with each other can also not be satisfied.

Local area network (LAN), an information transport system which provides high speed connection between personal computers within a distance of less than a mile, seems to be able to solve the above problems. This report is aimed at finding the market potential of LANs and identifying the customer profile.

The findings of this report indicated that the LAN industry is still in its infancy. Awareness of the concept of LAN is not high among the business executives. The total number of LANs in Hong Kong is still rather small. Companies which have implemented LANs are mainly large business firms, not those smaller firms which have been named as the target market by the dealers.

Competition is very keen. Many different brands of LANs are available in the market and people find it difficult to choose. There is actually no standardized LAN products at the moment and companies are waiting to see what

will happen in the market. Moreover, the business world still prefers mini-computers over LANs because of the better security system.

In the writers' opinion, the anticipated introduction of the IBM Token Ring LAN in the near future, together with a more mature development of the LAN products, should have the ability to switch the present market situation. However, more aggressive promotion must first be done by the dealers to educate the potential customers the need of LANs for their personal computers.

TABLE OF CONTENTS

LIST OF EXHIBITS

CHAPTER I

INTRODUCTION

1.1 New Trend in Office Automation

As personal computers have moved into the office environment and become more and more popular over the past several years, the advantages they bring by increasing the productivity and effectiveness of managers, accountants and secretaries have been accepted by almost everyone. Word processing, spreadsheets, accounting, and data base uses are now an everyday activity for more and more office workers in many companies. The personal computer, once a hobby for the computer "hacker", has become as indispensable as the telephone and the typewriter for business organizations.

As we have begun to rely heavily on these stand-alone desktop personal computers, we realize that something is missing. When each computer user keeps a personal filebox of floppy disks, each with different data and files, the sharing of information requires passing disks and printouts back and forth. Access to data for broad management decisions is difficult, since the information is scattered among many different users and stored in many different programs and formats.

There exist two problems. First, compatibility of personal computer hardware and, more importantly, software, is essential to making maximum use of corporate data. Second, we need to pay more attention to the communication of information from machine to machine.

The above mentioned problems can be solved by the use of Local Area Networks (LANs), which connects all personal computers in an office, allowing standardization of programs and data, and ready interchange of information among users. The existence of a ready communication path among users also enables use of new facilities such as electronic mail, electronic calendars, and other features of an "electronic office".

1.2 Local Area Network Defined

A Local Area Network (LAN) is an information transport system that provides high speed connection between personal computer work-stations within a building or a complex of building. It uses a common wiring system, a common communication adapter, and a common access protocal to allow connection between users. LANs enable users to share information and tap into a common database, thus saving the cost of individual computer peripherals and increasing overall productivity. A LAN has the following four key characteristics:

* It is, by nature, a limited-distance transmission system -- typically less than a mile;

* Data transmission is rapid -- usually over 1 million bits per second (Mbps);
* The network is owned by an organization for its own use within a local area (a building, a department, a branch, etc.);
* LANs are configured under the concept of distributed computing in which the distribution of function among a number of devices makes direct access more feasible than requiring all functions to reside in a central computer.

The last, and the most important, characteristic marks the difference of LANs from centralized multi-user systems in which all communication and data processing capabilities depend on the performance of a single large host computer.

1.3 The Purpose of Research

As LANs are still relatively new to the business world in Hong Kong, our study in this area is essentially exploratory. In our report, the main objective is to find out the market potential of LANs in Hong Kong.

We will concentrate our study on three areas and the following three questions are to be answered in the latter parts of our report.

1) Whether LANs are justified as compared with stand-alone personal computers?

One of the major advantages of LANs is to share expensive storage space and other peripherals like

quality printers and plotters. Using a LAN to link up stand-alone personal computers will therefore reduce the cost of the whole computer system within a company. However, the implementation cost of a LAN is rather expensive and may exceed the amount saved by the sharing of expensive peripherals. In view of such a problem, we try to do a cost-benefit analysis on LANs, aiming at identifying a critical point where implementing a LAN will result in cost saving.

On the other hand, LANs cannot be justified by only looking at their costs. LANs can bring some features that cannot be provided by stand-alone personal computers. Electronic mail and communications to large public databases are good examples of these features. In our research study, we wish to find out from manufacturers about all the advantages and improvements which can be brought by LANs. Moreover, we also try to ask the potential users how they view and weigh these advantages and improvements.

2) Which is best for team computing? LANs or Multi-user Systems?

A LAN must not be mixed up with a multi-user system. A multi-user system is a network of screens, storage units and printers, usually all from the same manufacturer, which all use the same software at the same time. It is a centralized system under which distributed processing is impossible.

The most obvious comparison between a LAN and a multi-user system will be in terms of their costs. We will compare their costs at different levels of requirements and try to see if one is cheaper than the other.

The second area of concern is performance. It is difficult to say which system will perform better in a general sense. It depends on situations. Under one environment LANs may be superior to multi-user systems, but under another multi-user systems may perform much better than LANs. We therefore try to identify a list of conditions which LANs will be more favourable.

Degree of control is another major concern. Some business organizations are very tight in controlling the flow of important information and therefore would not like everyone to gain access to such information. We will discuss the control mechanisms provided by LANs and multi-user systems and try to make decisions for potential users under different circumstances.

Another important aspect is distributing functions. The amount of distributing functions required by business firms will again depend on individuals. We will discuss the conditions under which LANs is the sensible choice for team computing.

3) What is the customer profile in Hong Kong?

Perhaps the most important part of our research project is to identify the customer profile. First of all, we need to find out who would be the potential

users of LANs. We then try to identify the characteristics of these potential users. The followings are typical questions which we would like to know the answers:

a. What kind of companies are interested in LANs?

b. What are the sizes of these companies?

c. What do they expect from LANs?

d. Are they willing to invest a lot of money on LANs?

With the answers to the above questions, we would be able to have a clear picture of the LAN market in Hong Kong and such information will be valuable for LAN dealers to market their products. The information will also provide a guideline for future development to be made by LAN manufacturers.

CHAPTER II

THE CLASSIFICATION OF LANs

2.1 The Network Architecture

LANs architecture defines the way data is communicated among computers, terminals and other information processing devices. Most LANs have been designed by using the International Standards Organization's Open System Interconnection (ISO/OSI) model as a reference. This seven-level model represents a standard approach by which information can be communicated through the network (see Exhibit 2.1). The lower two levels of the ISO/OSI model address the topology, signal type, access method and transmission medium, which are typically implemented in network hardware. The other five levels ensure the reliable transport of information between sending and receiving computer systems, networks or peripheral devices. To date, these five levels have been implemented by software programming.

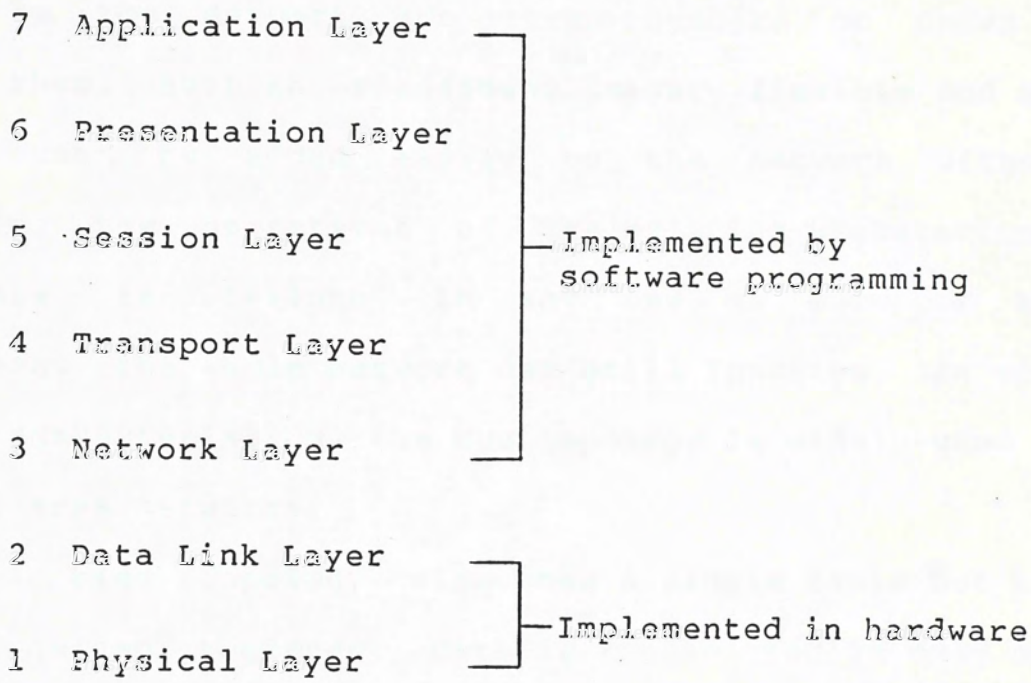
The major characteristics of the hardware or lower levels of the ISO/OSI model can be summarized as follows:

2.1.1 Topology

The topology of a local area network is the way in which devices in the network are linked together. There are

EXHIBIT 2.1

ISO/OSI REFERENCE MODEL



basically three different types of topologies, namely bus, ring and star. Exhibit 2.2 shows the three types of topologies.

A bus topology has workstations and other devices linked to a single cable which has terminators at each end. Machines in the network are given numbers or names to identify them. Such an arrangement is very flexible and new machines can be added easily to the network without interrupting the operations of the existing workstations. When there is failure in any one or more of the workstations, the whole network can still function. In view of such characteristics, the bus topology is widely used in many local area networks.

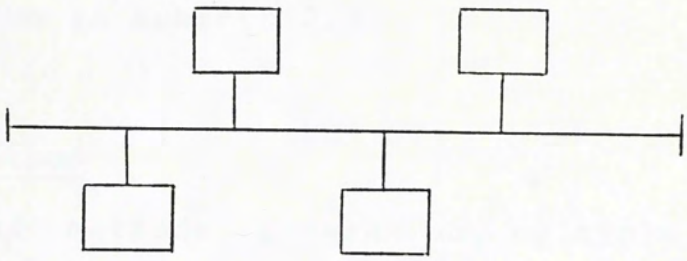
A ring topology also has a single cable but the ends are joined together. Data is transmitted in only one direction and is passed from one machine to another until it arrives at its destination. Ring topology has the advantage of covering a larger area than a bus topology. It also has the capability to handle different transmission media which is usually impossible for most bus networks. However, if new devices are to be added to a ring network or a single workstation within the network breaks down, the whole network will be paralyzed.

The third type of topology is the star arrangement. It has one central controlling device through which all transmissions must pass. A powerful micro-computer usually acts as the central controller and all other workstations are linked to it. In such a

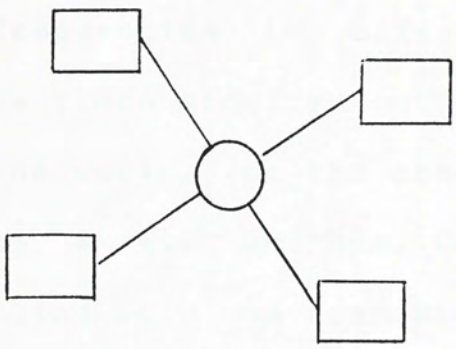
EXHIBIT 2.2

NETWORK TOPOLOGY

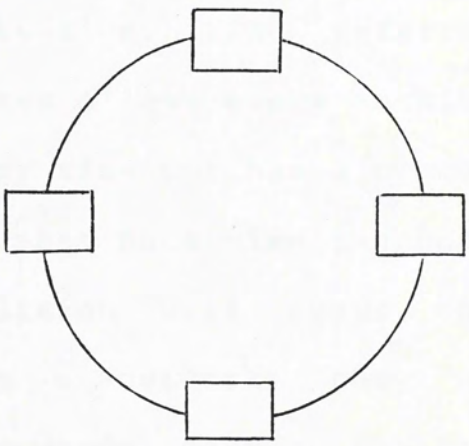
BUS

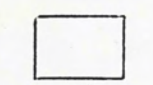


STAR

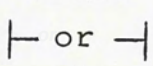


RING





Workstation, computer, printer etc



Termination in a bus

Central computer

configuration, if any one of the workstations fails, the network can still operate. However, if the control unit fails, the whole network will break down.

A comparison of different topologies of local area networks is shown in Exhibit 2.3.

2.1.2 Access Method

Access methods govern how multiple transmissions are conducted over one cable. Broadband network systems use a method called Frequency Division Multiplexing (FDM) to assign different frequencies to different transmissions, enabling them to take place simultaneously.

Baseband networks, on the other hand, employs one of the two primary access methods, CSMA/CD or token ring passing, each permitting only one transmission at a time.

CSMA/CD stands for Carrier Sense Multiple Access with Collision Detection, also referred to as contention checking. The system allows every machine on the network to transmit data at any time but has a procedure to prevent two machines trying to send data simultaneously. If it does not do this data collision will occur on transmission. If signals collide on a network, they will affect the data integrity - in other words, corrupt the information.

The major advantage of CSMA/CD is simple and inexpensive. It is particularly suitable for systems where the transmission load is not heavy.

Token passing is a system which circulates empty "tokens", which can be filled up with information around the

EXHIBIT 2.3

COMPARISON OF DIFFERENT TOPOLOGIES IN LANs

	Bus	Ring	Star
Connection Cost	Low	Low	Medium
Expansibility	Good	Moderate	Poor
Flexibility	High	Medium	Low

Source: "Basic Technology of Local Area Networks", Computronics, May 1984, P.106.

EXHIBIT 2.4

CHARACTERISTICS OF THREE COMMON LOCAL AREA NETWORKS

	Omninet	Ethernet	PC Network
Topology	Bus	Bus	Star
Signal Type	Baseband	Baseband	Broadband
Access Method	CSMA/CD	CSMA/CD	CSMA/CD
Transmission Medium	Twisted Pair Cable	Coaxial Cable	Coaxial Cable
Data Transmission Rate	1M bps	10M bps	2M bps
Max. No. of Nodes	64	1024	255
Max. Distance Between Nodes	4000ft	2.5km	2000ft
Price per node (US$) (includes one interface card and necessary software)	495	710	645

Source: "Basic Technology of Local Area Networks", Computronics, May 1984, P.103.

network. When a device requests transmission, one of these tokens is intercepted and information is placed in it. The token is then sent back around the network and is intercepted at its destination. Most real-time systems use this controlling method.

2.1.3 Signal Type

The two major signal types are baseband and broadband. Baseband carries two-way digital signals at very high speeds (up to 10M bps) along a single channel. Broadband carries low-speed (less than 2M bps) digital communications and can also carry analog voice or video signals. Moreover, broadband can transmit data simultaneously in many different channels over the same cable.

2.1.4 Transmission Medium

Local area networks can utilize many different media to transmit data. The most commonly used media are twisted pair cable, baseband coaxial cable, broadband coaxial cable and fiber-optic cable.

Twisted pair cable is just like ordinary telephone wire. It is inexpensive and easy to install. The transmission rate (the rate at which data is transmitted around the system) of twisted pair ranges from 250K bps to 2M bps. However, its bandwidth is relatively narrow and it is not well protected from electromagnetic interferences.

Baseband coaxial cable, when compared with twisted pair, is more expensive. However, its bandwidth is much wider and the transmission rate is faster. The typical transmission rate of this medium is about 10M bps. Since baseband coaxial cable is more cost effective, many local area network manufacturers choose it for their systems.

Broadband coaxial cable differs from baseband coaxial cable that it has even wider bandwidth and supports more than one channel. Wider bandwidth also enables networks to transmit messages in longer distance. Broadband networks are therefore expensive but have high performance. Large computer manufacturers like Wang are concentrating their efforts in the broadband local area networks in order to compete with the baseband networks.

Fiber-optic cable is a totally different medium. Fiber-optic communication is the transmission of signals as pulses of light through hair-thin pieces of glass, as opposed to the standard method of sending electrons through wire. The ability to transmit high-speed data over longer distances than are possible with twisted pair or coaxial cables is an definite advantage of fiber optics. Fiber optics also are immune to electromagnetic interference and there is practically no limit to the bandwidth. At the moment, fiber-optic cable is still rather expensive. As the price of the fiber-optic cable continues to decrease, we would see more networks utilizing this type of transmission medium.

2.2 Networks in Hong Kong

There are many different local area networks available in Hong Kong. Among the most well-known ones are Corvus' Omninet, 3Com's Ethernet and IBM's PC Network. A comparison of these three local area networks can be found in Exhibit 2.4.

2.2.1 Omninet

Omninet has been available since 1981 and probably has more users than any other micro-computer local area networks. Omninet is a very flexible network as different micro-computers can be connected with it. These micro-computers include IBM PCs, Apples, DEC-Rainbow and many others.

It can use an existing hard disk as the file server (a server is a piece of firmware which allocates resources amongst a network's users), thus reducing the initial cost of the network. Omnishare, which includes a transporter card plus network software, allows an IBM XT or AT with attached hard disk to emulate a Corvus Omnidrive (the server which the Omninet manufacturer recommends), thereby allowing other IBM PC stations to share data on the hard disk.

It uses relatively inexpensive twisted pair telephone wire as transmission medium and the maximum distance between two nodes is 4,000 feet. Up to 64 workstations can be used on Omninet but it is recommended not to have more than five or six users on each server. This is a common problem with file server-based LANs. The

file server is doing all of the work, directing data traffic around the system and trying to read and write files. Basically, the bigger the Omninet, the slower it will be.

2.2.2 Ethernet

Ethernet is a high-performance, bus-oriented local networking system initially designed by Xerox Corporation in the early 1970's. It was later established as a standard by Digital Equipment Corporation, Intel Corporation and Xerox.

3Com's Etherseries is a family of multivendor supportive hardware and software products which adheres to the Ethernet standard. The Etherseries is aimed primarily at the IBM and IBM PC-compatible market.

It is a baseband network and uses coaxial cable as transmission medium. It will operate over both thick (standard) and thin Ethernet coaxial cabling for distances of up to about 1,000m, although longer distances (up to 2.5km) can be achieved with signal repeaters. A notable feature of Ethernet is its transmission speed of 10M bps. In addition to facilitating high-performance communication applications such as disk sharing, this speed makes networks with very large numbers of stations viable.

Three server types are available: IBM XT/AT, 3Com's 3Server and DEC's VAX. At the low end, an IBM XT or AT with a hard disk will act as the server and services 2 to 8 users, or more, depending on the applications. When equipped with the 3Com interface card and appropriate software, an IBM XT becomes a network server with 10 MB of disk space available.

With a dedicated 3Server from 3Com, which contains a high-performance processor and a 70-megabyte disk, the network can service 6 to 30 users. At the high end of the server product line, 3Com has a kit which converts a VAX into a network server.

2.2.3 PC Network

PC Network is a broadband local area network offered by IBM which is exclusively designed for the family of IBM personal computers. As IBM has clearly positioned the token ring network to be its mainline system of the future, many industry analysts view the PC Network as a provisional system that serves as a stop gap until the token ring is completed.

PC Network uses standard coaxial cable as transmission medium. Any workstation with a hard disk on the network can act as a server and can support up to 32 concurrent users. It can support up to 72 nodes but the workstations have to fall within nine clusters of eight PCs. The speed of PC Network is 2M bps which is relatively slow when compared with Ethernet. As the number of stations per network increases, the speed of the PC Network itself will increasingly become the performance bottleneck.

Overall speaking, the IBM PC Network is not a widely used local area network in Hong Kong, despite the fact that it is an IBM product.

CHAPTER III

METHODOLOGY

Since this report was an exploratory study, we tried to obtain information from a variety of sources in order to widen the scope of our perspectives. The major data collection methods in this study included library research, in-depth interviews and questionnaire survey. Each would provide, as we expected, valuable insight in different areas. We scheduled our study into three phrases as follow:

3.1 Phase 1: Preliminary Investigation

In this phrase, the main objective was to get a general idea of LANs and their marketing activities in Hong Kong. Information collected in this phrase was used for structuring our questions in the subsequent in-depth interviews and for designing the questionnaire. Information mainly came from three sources:

1. Library Research: Most of the technical information about LANs was the result of this library research. Besides, the articles also provided a general comment on the performance of LANs. These were valuable materials for us to lay down the dimensions of investigation. The books, research papers and articles that the writers came across in this extensive research are included in the bibliography of this report.

2. Interviews: We tried to arrange informal interviews with those familiar with computer services operations. In this phase, we have discussed the issue with staff from:

   DAW Computer Systems Ltd.

   Computer Services Centre of The Chinese University of Hong Kong

   Microcomputer Lab of United College

   They provided helpful opinions for the later phases of this study.

3. Magazines: The increasing number of news items and advertisements related to LANs gave us a feel about the development of the LAN market in Hong Kong. Moreover, we obtained a list of LAN dealers and distributors from these advertisements.

3.2 Phase 2: In-depth Interviews

In this phase, most of the time was spent on interviewing existing dealers and distributors of Local Area Networks and users from different industries. The list of LAN suppliers interviewed include the following:

- IBM World Trade Corporation
  (Distributor of PC Network)
- Dodwell (Business Machine Section)
  (Dealer of PC Network)
- Convergent Microsystems (HK) Ltd.
  (Dealer of SuNet, Ethernet, and Omninet)
- 2001 Computer System (HK) Ltd.
  (Dealer of Omninet and Ethernet)
- DataLink Computer Systems Ltd.
  (Dealer of Omninet)
- COMPAC Microelectronics (HK) Ltd.
  (Distributor of Omninet)

- Imagineering Micro Distributors Ltd.
  (Distributor of Ethernet)

- Kwok Kin Enterprise Ltd.
  (Dealer of K-Net, mainly to Mainland China)

The questions asked during these interviews were concentrated in the following dimensions:

1. Price of microcomputers, multi-user systems, and LANs
2. Performance
3. Data control
4. Market size and market share
5. Target customers
6. Competitors
7. Distribution networks

Appendix A presents a list of the "core questions" asked during each of these interviews.

We obtained a list of current users of LANs and multi-user systems from the interviews with these dealers but the response from users was not as good. Nevertheless, we finally arranged interviews with three of them:

- Hong Kong Electric -- Ethernet
  (Public utilities)

- COMPAC Micro-electronics (HK) Ltd. -- Omninet
  (Computer peripherals distributor)

- Hong Kong Air Cargo Terminals Ltd. -- PC Net
  (Transportation)

Questions posted to these users covered those areas as:

1. Potential needs for data communication, data control and distributed computing
2. Current computing facilities in use
3. Comments on the LANs or multi-user systems in use

4. Cost considerations
5. Characteristics of the company such as size, industry involved, etc.

Appendix B is a full list of the questions asked in the interviews. These interviews provided more information on the performance of LANs under operating environments. Besides, another purpose for interviewing these user companies was to test the questionnaire for the subsequent survey.

3.3 Phase 3: Questionnaire Survey

The main purpose of this survey was to identify the characteristics of potential users and to understand the attitude of the companies in Hong Kong towards Local Area Networks. The questionnaires were mailed to the EDP department managers of a selected sample of companies in Hong Kong. They were requested to complete the questionnaires and mail them back to the writers. The data was input into the computer for statistical analysis by SPSS packages.[1] Frequency counting, cross tabulation and discriminant analysis[2] were the major methods used in analyzing the data collected from this survey in order to obtain a descriptive market profile.

---

1. Norman H. Nie et. al, Statistical Packages for the Social Sciences, 2nd ed., McGraw-Hill, 1975.

2. ibid. p. 434-467. For more details about discriminant analysis, see Morrison, Donald G.: "Discriminant Analysis", in Robert Ferber ed., Handbook of Marketing Research, New York, McGraw-Hill, 1974.

3.3.1. Questionnaire Design

Appendix C is a sample of the questionnaire to be filled in by the EDP managers. This questionnaire was constructed from the information provided by our respondents during the interviews. It was designed to measure the characteristics of each company in three dimensions: general characteristics, investment in computer facilities, and pattern of computer operations. We tried to identify the relationship between these characteristics and the potential of installing a local area network.

3.3.2. Measurement of the Dependent Variable

The dependent variable in this study is the potential of a company to install a local area network. We measured this variable by two questions:

- Is your company a user of local area network?
- Can you estimate the probability that your company will install a local area network in the next 2 years?

For the second question, respondents were requested to indicate his estimate in a 5-point scale ranging from "impossible" (1) to "very likely" (5). A company would be classified as "high potential user" if it gave a response of 4 (likely) or 5 (very likely) in this question or if it is currently a local area network user. The other cases in our sample were then named as "low potential users".

3.3.3. Sampling

Since the LAN dealers have indicated that those companies without internal system support staff are not likely to use LAN, they must have some knowledge about it before they attempt to try. As a result, we decided to concentrate our effort on those companies that have at least one EDP staff. This immediately excluded most of the small companies in Hong Kong. We contacted the Hong Kong Management Association in order to get a list of EDP staff as our population frame. A random sample of 140 was drawn from the list and questionnaires were mailed to these companies. Exhibit 3.1 shows the number of establishments by industry in our sample. A total of 46 questionnaires were returned representing a response rate of 32.9% (Exhibit 3.2). Although this is a reasonable return rate for mailed questionnaire survey, such a low rate may make our sample not representative enough to infer to the whole market in Hong Kong. But since this is an exploratory study, we believe that our findings can provide useful clues to both LAN dealers and potential LAN users to generate their own insight into this developing market of local area networks.

EXHIBIT 3.1

DISTRIBUTION OF COMPANIES SURVEYED BY INDUSTRY

Industry	No. in Sample Frame (%)	Questionnaires Mailed (%)
Finance	55 (25%)	36 (26%)
Trading	59 (27%)	37 (26%)
Manufacturing	35 (16%)	26 (18%)
Computer Related Industry	72 (32%)	41 (30%)
Total	221 (100%)	140 (100%)

EXHIBIT 3.2

FREQUENCY OF QUESTIONNAIRES RECEIVED BY INDUSTRY

Industry	Questionnaires Received (%)	Return Rate
Finance	5 (11%)	14%
Trading	20 (43%)	54%
Manufacturing	13 (28%)	50%
Computer Related Industry	8 (18%)	20%
Total	46 (100%)	32.9%

CHAPTER IV

MARKET SIZE AND PENETRATION

4.1 The U.S. Market

As the PC local area network industry in Hong Kong is still in its infancy, we could not obtain statistics about the sales or the market size of it. However, we managed to obtain some U.S. statistics on local area networks. With such statistics, the readers should have an idea of the trend in the U.S. market and hopefully Hong Kong will follow a similar trend.

As can be seen from Exhibit 4.1, the total number of PCs in U.S. will continue to grow at rate of 40% annually over the next few years (Although the actual trend seemed to slow down in 1985, we still believe the cumulative PC base will grow). More end users of stand-alone PCs will naturally increase the number of potential local area network users. On the other hand, the price per node is expected to decline about 20% annually, resulting in a more favourable environment for PC users to install local area networks.

Although it was only estimated that the LAN market will have an eventual 5% penetration of the U.S. installed PC base in 1988 (see Exhibit 4.1), the increase in number of nodes connected by local area networks will still be

EXHIBIT 4.1

PROJECTED GROWTH OF PC AND LAN MARKET IN U.S.A.

PCs (thousands)	1983A	1984E	1985E	1986E	1987E	1988E
New Shipments	4,250	5,950	7,600	8,740	9,600	9,850
Retirements	400	705	1,500	2,400	3,250	4,100
Cumulative Base	6,400	11,645	17,695	24,035	30,385	36,125
% PCs in LANs	.8%	.9%	2.1%	3.1%	4.3%	5.0%
Nodes (thousands)	50	105	370	750	1,300	1,800
Node Pricing	$1,100	$ 750	$ 600	$ 480	$ 384	$ 326
Node Revenues ($ millions)	$ 55	$ 79	$ 222	$ 360	$ 499	$ 587

Source: "Data Communications & Data Storage Purchase Recommendation", an investment research by David K. Moy of Morgan Stanley, September 18, 1984.

A = Actual

E = Morgan Stanley Research Estimates

substantial. The number of nodes in 1983 was only 50,000, but it will increase to 1,800,000 in 1988. The unit volume of PC LAN nodes will therefore increase more than 100% per annum over the 5-year period from 1984 to 1988.

In fact, more optimistic forecast of the installed base of PCs are for about 45 million units in 1988, and a penetration rate of 30% has been projected by some industry observers. For such an optimistic forecast, the number of nodes will reach an enormous figure of 13.5 million in 1988. However, we believe the conservative estimates of Morgan Stanley are more reasonable figures and we will take them as an indicator of the U.S. LAN market.

EXHIBIT 4.2

INSTALLED OMNINET USER BASE IN U.S.A.

	1982	1983	1984E
Networks	950	3,400	15,000
Microcomputers	4,200	33,000	105,000
Average Users	4.4	9.7	7.0

Source: Data Communications & Data Storage Purchase Recommendation", an investment research by David K. Moy of Morgan Stanley, September 18, 1984.

E = Morgan Stanley Research Estimates

With regard to the market share, Corvus Systems (manufacturer of Omninet) has been the dominant supplier of PC local area networks over the past few years and has an installed base of over 105,000 users (see Exhibit 4.2). It has captured 60% of the LAN market in U.S.A. because of its relatively lower cost of implementation. However, the average users of Omninet are beginning to decline. It indicates that large network users are possibly switching to other networks, such as Ethernet.

As a summary, the U.S. LAN market is expanding at a very rapid pace and there is a lot of potential in this industry.

4.2 The Hong Kong Market

Although there are no official statistics about the local area networks in Hong Kong, we managed to find the market size from other sources. Exhibit 4.3 shows the number of microcomputer systems imported into Hong Kong from 1983 to 1985. The number of microcomputer systems imported for the period from January to October in 1985 had reached 83,867, which was about twice as many as the total number for the year 1984. Based on the figures shown in Exhibit 4.3, together with some estimates from experts in the computer industry, we believe the total number of microcomputers in Hong Kong is about 150,000.

On the other hand, Mr. A. Yue of Datalink Computer Systems Ltd. (a major dealer of Omninet in Hong Kong) has made an estimate about the market size of local area

EXHIBIT 4.3

MICROCOMPUTER SYSTEMS IMPORTED INTO HONG KONG

	Number	Value (HK$)
1985 (Jan -Oct)	83,867	462,150,259
1984	45,190	519,248,731
1983	10,813	177,216,032

Source: Hong Kong Trade Statistics

EXHIBIT 4.4

CALCULATION OF PENETRATION RATE

Total number of PCs = 150,000

Total number of networks = 500

Average number of nodes per network = 5

Penetration Rate = total number of nodes / total number of PCs

= ((500 * 5) / 150,000) * 100%

= 1.666%

networks in Hong Kong during an interview with the writers. He estimated that the total number of local area networks installed in Hong Kong would be around 500 at the moment. Such a figure has been confirmed by several other experts in this field.

Assuming the average number of nodes in each network is five (Since many networks in Hong Kong are relatively small, this figure may be lower than the average in U.S.A.), we get a penetration rate of about 1.7% (see Exhibit 4.4). Such a penetration rate, though less than the estimated U.S. figure of 2.1% in 1985 (see Exhibit 4.1), is a very encouraging sign. As there is always a time-lag in the computer industry between the U.S. and Hong Kong market, we initially expected a much smaller penetration rate.

Out of the 500 local area networks installed, Mr. Yue estimated 250 of them are Omninets, 100 of them are Ethernets, and the remaining 150 are made up of many different brands (see Exhibit 4.5).

EXHIBIT 4.5

MARKET SHARE OF DIFFERENT LOCAL AREA NETWORKS IN HONG KONG

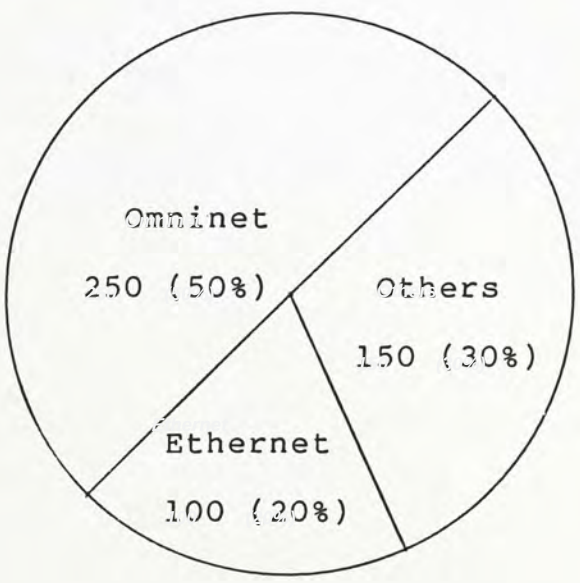


Exhibit 4.5 clearly indicates that Omninet is the market leader in the Hong Kong local area network market. It has about 50% of the total market share which is in line with the U.S. statistics. On the other hand, there is a trend for Ethernet to gain market share which is also in line with the U.S. market situation.

As the penetration rate and market share information of Hong Kong are comparable to that of U.S.A., we feel comfortable to infer the U.S. statistics to the Hong Kong market. As the personal computer market continues to grow (see Exhibit 4.3), we believe that the LAN market in Hong Kong will continue to grow at a rather rapid rate. We also anticipate the penetration rate of local area networks in Hong Kong to reach the 5% mark eventually, as that predicted for the U.S. market.

CHAPTER V

FINDINGS

This chapter will give a summary of the important findings from the in-depth interviews with the dealers and end-users; together with the results obtained from the questionnaire survey.

5.1 LAN Users

Most dealers admitted that there are not too many end users of local area networks in Hong Kong. Our survey findings agreed with this. Exhibit 5.1 clearly indicates that the percentage of LAN users within our sample is only 10.9%; which is very small when compared with a 56.5% of Mini-users.

EXHIBIT 5.1

NUMBER OF LAN AND MINI USERS

	Number	%
LAN user	5	10.9
Mini-user	26	56.5
Neither	18	39.1
Total*	46	100

* Since LAN users can also be Mini-users, the totals are not the aggregate of the three categories.

5.2 Company Size

Most network dealers told us that their potential target customers should be medium to small size business firms which will find the concept of sharing a common data base and expensive peripherals attractive. However, the actual end users of many local area networks in Hong Kong are mainly large business organizations. Exhibit 5.2 shows that companies with more than 500 employees have higher potential in installing local area networks. This group of companies has a 50% probability of installing LANs, while the remaining two groups have a probability of less than 30%.

5.3 Budget

Exhibit 5.3 shows the relationship between the potential of using local area network and the companies' annual budget in data processing. It can be seen that companies will be more interested in local area networks when their data processing budget is over HK$ 1million. As the cost of installing a LAN is only relative small to their budgets, they are more willing to spend the money.

5.4 Computer Operations

Exhibit 5.4 shows the percentages of time spent on different computing activities by different groups of companies. For the companies with micro-computer systems, it can be seen that they spent relatively high percentage of time (28.9%) on database management. The concept of sharing

EXHIBIT 5.2

NUMBER OF RESPONDENTS INTERESTED IN LAN

BY COMPANY SIZE

NO. OF EMPLOYEES

POTENTIAL LAN USER	COUNT / ROW PCT / COL PCT / TOT PCT	Less than 50 (1.)	50-500 (2.)	More than 500 (3.)	ROW TOTAL
1. YES	COUNT	4	3	6	15
	ROW PCT	26.7	33.3	40.0	33.3
	COL PCT	28.6	26.3	50.0	
	TOT PCT	8.9	11.1	13.3	
2. NO	COUNT	10	14	6	30
	ROW PCT	33.3	46.7	20.0	66.7
	COL PCT	71.4	73.7	50.0	
	TOT PCT	22.2	31.1	13.3	
COLUMN TOTAL		14 / 31.1	19 / 42.2	12 / 26.7	45 / 100.0

EXHIBIT 5.3

NUMBER OF RESPONDENTS INTERESTED IN LAN

BY BUDGET ALLOCATED TO DATA PROCESSING

BUDGET (HK$)

POTENTIAL LAN USER	COUNT / ROW PCT / COL PCT / TOT PCT	Less than 200,000 (1.)	200,000-1,000,000 (2.)	More than 1,000,000 (3.)	ROW TOTAL
1. YES	COUNT	2	3	9	14
	ROW PCT	14.3	21.4	64.3	32.6
	COL PCT	20.0	21.4	47.4	
	TOT PCT	4.7	7.0	20.9	
2. NO	COUNT	8	11	10	29
	ROW PCT	27.6	37.9	34.5	67.4
	COL PCT	80.0	78.6	52.6	
	TOT PCT	18.6	25.6	23.3	
COLUMN TOTAL		10 / 23.3	14 / 32.6	19 / 44.2	43 / 100.0

a common database should therefore be attractive to these companies.

Although programming and system maintenance only occupies 15% of the total time spent for micro-computer users, it may still attract some potential LAN customers because they can share common softwares.

One of the advantages provided by LAN is electronic communication with others. However, our respondents only spent 1.7% of their time in electronic communication; making electronic mail not a selling point to these companies. In fact, existing LAN users and dealers both admitted that electronic mail is not very useful.

EXHIBIT 5.4

% OF TIME SPENT IN DIFFERENT COMPUTER OPERATIONS

	Major Type of Computer System		
Computer Operation	Mainframe	Mini-computer	Micro-computer
Word Processing and Reporting	17.6%	20.0%	29.4%
Electronic Communication	10.0%	4.7%	1.7%
Database Management	12.9%	5.5%	28.9%
Data Processing	36.8%	45.3%	23.9%
Programming and System Maintenance	19.8%	21.3%	15.0%
Others	2.9%	3.2%	1.1%
Total	100.0%	100.0%	100.0%

5.5 Opportunities

From our survey findings, the concept of sharing resources (harddisk storage and printers) is actually very attractive to many business organizations in Hong Kong. Exhibit 5.5 shows that the occupancy of harddisk by data and programs is rather small, especially for companies using micro-computers as their major type of computer system (31.1%). Such an occupancy rate indicates that a lot of storage space has been wasted. If these micro-computers are linked up together by local area networks, we expect these companies can save a lot on the harddisk storage.

EXHIBIT 5.5

AVERAGE HARDDISK OCCUPANCY FOR RESPONDENTS USING DIFFERENT COMPUTER SYSTEMS

Major Type of Computer System	% of Harddisk Storage Occupied
Mainframe	65.6%
Mini-computer	56.1%
Micro-computer	32.1%

Utilization of printers is also rather low when compared with that of micro-computers or terminals for most firms. For companies with micro-computers as the major computer system, the percentage of time when their

micro-computers are in use is 47.8% (see Exhibit 5.6), which is considerably higher than the figure of 16.7% for printers (see Exhibit 5.7). The micro-computers usage is about three times as much as that of printers and it can clearly be seen that the printers are under-used. Again, these companies should be very interested in local area networks based on the fact that the number of printers can be reduced if the micro-computers are connected together.

5.6 Promotion and Distribution Network

The promotion done by the LAN distributors and dealers has been minimal. They usually place advertisements in some computer magazines and wait for the potential customers to call. On the other hand, some exhibitions specifically about local area networks have been organized by some LAN dealers but the general public were unaware of these exhibitions.[1] The writers did go to one of these exhibitions and found that it was too technically oriented. The salesmen just talked about the technical specifications and ignored the needs of the potential customers. People would not understand what the salesmen were talking about if they did not possess some knowledge about local area networks.

On the other hand, the dealers seldom approach the potential customers to create a need for LAN. According to Mr. E. Chang[2], the selling process of local area networks

---

1. A LAN exhibition organized by Cititat Ltd. in the Asia Computer Plaza, March 17, 1986.

2. E. Chang, Convergent Microsystems (HK) Ltd., Interview, January 23, 1986.

EXHIBIT 5.6

AVERAGE TERMINAL OR MICRO-COMPUTER USAGE

Major Type of Computer System	% of Time when Terminals/PCs in Use
Mainframe	76.7%
Mini-computer	65.8%
Micro-computer	47.8%

EXHIBIT 5.7

AVERAGE PRINTER USAGE

Major Type of Computer System	% of Time when Printers in Use
Mainframe	48.9%
Mini-computer	46.8%
Micro-computer	16.7%

usually go through some middlemen. These middlemen are mainly software houses which provide software and other computer support to their corporate clients. In many cases, the clients will ask the software houses to recommend a LAN for them when they find a need for it. The networks dealers therefore keep close contact with these software houses and try to identify some potential customers from them. In fact, many local area networks have been sold through the established relationships with these software houses.

5.7 Problems

There are quite a few objections against the use of local area networks in Hong Kong. The most serious problem is the lack of standard in the industry. There is not a single network which is being regarded as the industrial standard in the market, not even Ethernet. Many people are still waiting for IBM to introduce its own LAN and hopefully such a LAN will become the de facto standard. It was not until the end of 1985 IBM announced its Token Ring local area network in U.S.A. However, the Token Ring has not come to Hong Kong yet.

Another problem is the risk of obsolescence. It is very difficult at the present time to judge the life span of LAN equipment. New and better networks come into the market in a rapid pace and soon outperform the older ones. Moreover, there are many incidents at which LAN vendors are taken over by or merge with other manufacturers, or just fail. Customers are therefore not guaranteed of long-term service or support.

Data security is the area where customers complained most. According to Mr. Y. W. Ho[1], unauthorized access to the harddisk of his company's PC Net can be gained without much difficulty. In fact, all the end-users of LANs we have interviewed voiced a similar opinion. The dealers, on the other hand, also admitted the data security system of LANs is not as sophisticated as that of mini-computer systems.

5.8 Emphasis on the China Market

Most LAN dealers have paid much attention to the China market. In fact, most dealers admitted that a substantial percentage of the LAN equipment has been sold to China. An expert in the LAN industry estimated that such a percentage might be as high as 60-70%. As the China market looks so important to the LAN dealers, they apparently have put more effort in this market and ignored the Hong Kong market.

5.9 Characteristics of Potential Customers

5.9.1 The Analysis

In the study, the writers used the discriminant analysis method to identify the key "discriminating variables" which can distinguish high-potential users from low-potential users.

---

1. Mr. Y.W. Ho, Hong Kong Air Cargo Terminal Limited, Interview, February 17, 1986.

First we identified, from our questionnaire survey, a list of variables which may be related to the customers' decision. "Stepwise discriminant analysis" was used to eliminate the less useful issues before performing the actual analysis. Rao's V was used as the stepwise criterion.[1]

Exhibit 5.8 shows a list of the variables used in the analysis and the results of the stepwise procedure. Only 12 of the 22 variables were selected before the addition on Rao's V became insignificant. These 12 variables produced a very high degree of separation as indicated by a canonical correlation of 0.918 for the first (and only) discriminant function.

In analyzing the result, it should be borne in mind that the discriminant functions coefficient can be interpreted similar to that in multiple regression. They serve to identify the variables which contribute most to differentiate the criterion factor (dependent variable). For the reason of partialing out the effect caused by the different units of the independent variables (e.g. for some variables, 1 is the incremental interval, but for some other variables, 1000 is the incremental interval), standardized coefficients are used. Standardized coefficients are discriminant function coefficients adjusted by their own deviation. The sign and size of the coefficients determine the effect of the independent variables. The size shows the magnitude of the effect and the sign shows the direction of the effect.

---

1. For an explanation on "stepwise discriminant analysis" and "Rao's V", see Norman H. Hie, op.cit. p. 441-448.

EXHIBIT 5.8

IMPORTANT USER CHARACTERISTICS

Variables included in the Discriminant Function	Discriminant Function Coefficients	Standardized Coefficients
No. of Microcomputers	.07	2.22
No. of Plotters	.06	1.46
Concern for Security	-3.03	-1.44
% of Time Printers in Use	- .97	-1.29
No. of Printers	.81	1.24
No. of Employees	.01	1.16
Budget for EDP	1.40	1.14
% of Computer Time Used for Programming	.08	.97
No. of Internal System Support Staff	.04	.75
Foreign Capital	1.53	.72
% of Computer Time Used for Database Management	.04	.56
% of Harddisk Space Occupied	- .02	- .47

Rao's V = 175.82 Degree of Freedom = 13 Significance = 0.0

Canonical Correlation = 0.918

Variables excluded from the Discriminant Function:

No. of Terminals	No. of Harddisk Unit
Total Storage Capacity	% of Employees Using Computer
% of Time PC/Terminals in use	% of Computer Time Used for Word Processing
% of Computer Time Used for Electronic Communication	% of computer Time Used for Data Processing

Exhibit 5.8 gives the picture of the discriminatory power of the variables. The more powerful variables mean more important the factors in discriminating "high potential users" from "low potential users". The variables are ranked in descending order of their effect.

Before the variables are discussed in detail, the accuracy of discriminant analysis used in the study should be paid attention to. The accuracy of prediction of the method is shown by "Hits and Misses" table as appeared in Exhibit 5.9. The total prediction accuracy of the discriminant function is 94.59% (with only 2 misses out of the 37 predictions i.e. 9 cases are excluded due to missing values). From the table, it can be seen that the prediction accuracy of "high-potential" group is 100% and that for "low-potential" group is 92% which are quite satisfactory results.

5.9.2 Discriminating Variables

1. Existing facilities: The total number of micro-computers ranks first in its discriminating power with a standardize coefficient of 2.22. The number of plotters ranks second (1.46) while number of printers becomes fifth (1.24). The effect of these facilities are independent from the company's investment on dumb terminals since it has been excluded from the discriminant functions.
2. Concern for security: Concern for security is the third most important variable in the function. This reveals the

EXHIBIT 5.9

HITS & MISSES OF THE PREDICTED RESULT

Actual Group	No. of Cases	Predicted High-potential	Predicted Low-potential
High-potential Users	12	12 (100%)	0 (0%)
Low-potential Users	25	2 (8%)	23 (92%)

No. of Cases included in the Prediction = 37

% of Grouped Cases Correctly Classified = 94.59%

% of "Hits" for Group 1 (High-potential users) = 100%

% of "Hits" for Group 2 (Low-potential users) = 92%

fact that the company's control philosophy has an important part to play in making the decision.

3. Facilities utilization rate: The printer's utility rate and the storage utility rate rank fourth and twelfth in the variable list while the PC/terminal utility rate is insignificant. This is an evidence to support the contribution of LAN to cost reduction by sharing common resources (especially hard disks and printers).
4. Company size: The size of company (in terms of total number of employees) is the sixth important discriminating factor. Large company will generally have more resources allocated to EDP and the amount of this budget ranks seventh in our list. Besides, large company can afford to have a team of internal computing support staff which appears as the tenth discriminating factor.
5. Nature of task: The percentage of computer time used for database management and system maintenance/programming also help to classify users from non-users (they rank ninth and eleventh respectively). The time used for other applications such as word processing, electronic communication, and data processing/calculation have no effect here.

CHAPTER VI

DISCUSSION: COST & BENEFIT OF MOVING FROM ISOLATED PCs TO LANs

Local networking of personal computers provides three major benefits: peripheral sharing, information access, and inter-workstation communication. But how much would the users pay for such additional performance? We shall take a consideration on cost before discussing the benefits of LANs.

6.1 Cost Justification

LANs require additional cost on hardwares and softwares. These include network server, communication hardwares, sharing softwares, and installation cost. On the other hand, the total cost can be reduced by sharing of expensive equipment. The principal motivation for peripheral sharing is to distribute the cost of expensive but seldom-used peripherals, such as quality printers and fixed disk drivers, among the entire PC community. Exhibit 6.1 uses a case to illustrate how the additional cost is justified by cost saving from peripherals with increasing number of workstations.

LANs reduce expense by means of sharing resources. Our survey indicates that, on the average, only 45% of PC hard disk space is occupied by programs or data. Moreover,

EXHIBIT 6.1

COST COMPARISON AMONG LANs, MINIs AND STAND-ALONE PCs

Mr. Cheung of ABC Co. is calculating the cost of installing new computer facilities in his office. He has considered three alternatives: stand-alone PCs, local area networks, and multi-user minicomputers. The following is the cost for each alternative: (note 1)

Alternative 1: Stand-alone PCs

		(US $)
Initial installation cost:		$0
Cost for additional workstation:		
PC/XT (with 10 Mbyte Fixed Disk)	$4767	
FX-80 Printer	$510	$5277

Alternative 2: PCs linked by Ethernet

		(US $)
Initial installation cost:		
EtherServer (with 70 Mbyte disk)	$8995	
Sharing softwares	$1040	$10035
Cost for additional workstation:		
PC (without fixed disk)	$3254	
EtherLink with cable & user software	$742	$4096
Other cost:		
LQ1500 printer (1 per 5 users)		$1280
Expansion disk (for additional 70 Mbyte)		$4995

Alternative 3: Multi-user minicomputer (note 2)

	(US $)
Initial installation cost:	
System unit, disk drive & line printer	$64000
Cost for additional workstation:	
Terminal, communication hardwares & cable	$2400

Mr. Cheung knows that the total cost will depend on:
a. the total number of workstations required;
b. the amount of disk storage per each terminal user.

Assumptions: (note 3)

1. On the average, a high speed printer can handle the printing workload of 5 users.
2. A PC/XT user only uses about 45% of his storage capacity.
3. At least 30% of the software and data are common to all users. (note 4)

Based on these assumptions, a PC/XT user will normally need about 3.2 Mbyte (10M x 45% x (1-30%)) of storage in a shared peripheral environment. As a result, the total cost of installation will be a function of total number of workstations. This is tabulated in Exhibit 6.2 and plotted as graph in Exhibit 6.3.

Note to Exhibit 6.1:

1. Refer to price list in Appendix E
2. Since the price of minicomputers differs according to different configurations, we use the average cost of the sample in our survey result. Please refer to the tabulation of survey results (Appendix D).
3. The assumption of 20% printer usage and 45% fixed disk usage is based on our survey result. Please refer to the summary of survey findings (Chapter V).
4. 30% common softwares and data is a conservative estimate. In some departments, such as accounting department, the proportion may be as high as 90%.

EXHIBIT 6.2

CHANGE OF TOTAL COST WITH INCREASING NUMBER OF WORKSTATIONS

Number of Workstations	Total Cost		
	PC/XT	EtherNet	MiniComputer
0	$0	$10,035	$64,000
5	26,385	27,585	76,000
10	52,770	45,135	88,000
15	79,155	62,685	100,000
20	105,540	85,230	112,000
25	131,925	102,780	124,000
30	158,310	120,330	136,000

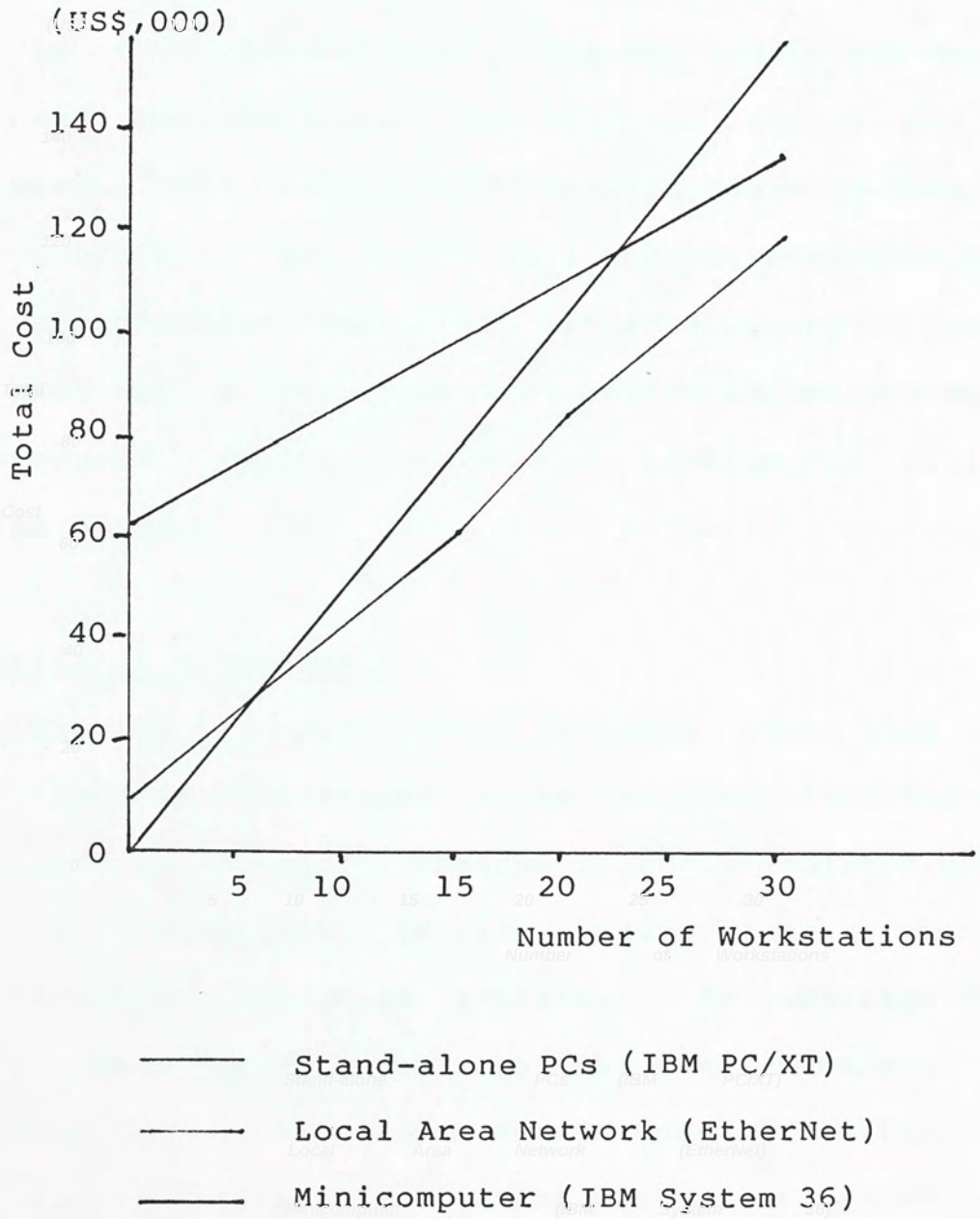
a considerable portion of these programs and data is common to all users in the organization. LANs eliminate the duplicate copies of common softwares and data so that more disk space can be saved in a shared environment. Other facilities such as printers and plotters are usually under-utilized. Our sample shows that those printers are only busy for about 20% of office hours. Therefore, a printer can serve five users in a shared network. Considerable saving can be obtained through a more efficient allocation of printer time under a network server.

Exhibit 6.2 & 6.3 show that installing a local area network will be cheaper than stand-alone PCs if the company requires 6 or more workstations. In small configurations, LANs will incur higher cost as a result of the initial investment on network server and softwares. For larger configurations (30 or more workstations) the cost of LAN is approaching the price of multi-user minicomputers. At this level, some company will prefer minicomputers for better performance in terms of processing time and information control. (We will discuss the comparative advantages of LANs and minicomputers in the next chapter.) Therefore, LANs enjoy an optimal cost efficiency for medium size systems (i.e. 6-25 workstations).

The illustration in Exhibit 6.1 has ignored many other miscellaneous costs for the sake of clarity. The actual break-even point may be somewhere greater or less than that shown in Exhibit 6.3. But the basic principle is clear: <u>For any organization, there is an optimum</u>

EXHIBIT 6.3

COST ADVANTAGE OF LANs OVER PCs AND MINIs



configuration size which local area networks will enjoy a cost advantage over stand-alone workstations or minicomputer systems.

6.2 Benefits of LANs over Stand-alone Workstations

In recent years, office automation professionals increasingly place more emphasis on the benefit rather than the cost reduction aspect of office automation. The basic argument is that information tools may enable new ways of thinking and collaborating, as well as better, not just faster, work. This "value-added" concept makes it insufficient to justify a LAN simply as a cheaper replacement for another communication facility. It is necessary to look at LAN as part of a comprehensive office-automation system which produces synergy effect by linking up isolated information bases.

6.2.1 Sharing of Peripherals

Sharing of peripheral is much more than cost saving. LAN is the answer to the question, "Can one ever have enough disk storage?" Because it turns isolated microcomputers into a network, LAN allows users of microcomputers share information and disk storage. By sharing these resources, users have access to the greater capacity and faster speed of a hard disk versus that of smaller, less reliable floppy diskettes. Existing disk space is used more efficiently because information is not duplicated. By using the same programs and data, local area network can eliminate diskette-swapping. It saves time.

Another less recognized, but equally important, benefit is the improvement of working environment by isolating noisy printers and other shared equipment from the work area in order to make for smaller and quieter workstations.

What is more, different people can send files to the shared printer at the same time. If the printer is busy, files are simply queued or "spooled" until it is free. When information to be printed is received, LAN server temporarily stores it on disk. A busy professional can then run other programs without waiting for the printer to complete the job.

Furthermore, there will be a synergy effect on economy of scale. Sharing of cost by all users makes it possible to cost-justify those high-priced equipment (such as laser printers, digitizers, and high-speed modems) for high quality office output.

6.2.2 Sharing of Information and Softwares

Sharing of information and softwares contributes to organization output in two areas: productivity and system control.

Information access enables several PCs to share common information. It has a significant impact on personal productivity not only because of the ease and speed of access, but also because the information is more timely and up to date. The contribution of LAN to productivity is difficult to quantify. But it can be revealed by the experience of Warner Lambert Co., as described by Mr. Joseph

McGrath, Manager of Office System and Services. In an LAN roundtable[1], he evaluated the performance of an LAN installed in his company:

> "...Proposal documents made the rounds of participants faster and cleaner than they did manually. We cut the number of steps required to produce our reports by 40 percent. We reduced the time required for each by 32 percent. And we began handling 27 percent more requests for evaluation."[2]

Results of a single company may not be projected to the entire population, but it can be taken as an indication of the potential benefits to organization productivity.

Sharing of information is a prerequisite for the implementation of "data-base concept" in an organization. One problem of stand-alone workstations is the difficulties in data control. Data are scattered among different workstations each operating on their own version of data. This is not a feasible way of operation in a team work environment, such as accounting team or programming team. Our survey finding indicates that security control for microcomputers is far from satisfactory as compared with that of mainframe or mini systems (Exhibit 6.4). In an LAN configuration, data access can be controlled by a hierarchical access path with password checking. (Minicomputer systems have better control devices than LANs. This will be discussed in the next chapter.)

Another control feature of LAN is data accuracy control. Data resident in one place with multiple access is not prone to errors of transcription and media conversion.

---

1. The series of roundtables was recorded in "LANs: The Promise and the Payoff", Computer Decision, April 1984, p. 92-110.

2. ibid, p. 94.

EXHIBIT 6.4

DATA SECURITY UNDER DIFFERENT FACILITIES

Opinion of Data Security in the Organization	Major Type of Computer Facilities		
	Mainframe	Minicomputer	Microcomputer
Good/Excellent	10 (56%)	9 (50%)	1 (11%)
Satisfactory/Poor/ No Control at all	8 (44%)	9 (50%)	8 (89%)
Total	18(100%)	18(100%)	9(100%)

Besides, the backup process is much easier for LAN. Isolated PCs need to have their own backup copies for each workstation. In a shared LAN, backup will be more efficient with centralized backup procedures.

In one of our interviews with LAN users, our respondent from Hong Kong Electric told us that LAN has another advantage during software upgrade. Software packages for microcomputers are changing in a rapid pace. Shared softwares in LAN needed to be upgraded once and for all while isolated microcomputers have to be done individually. Moreover, LAN would avoid the risk of using different versions of the same program which leads to the problem of incompatibility in later processing.

6.2.3 Communication among Workstations

The most underrated benefit of LAN is personal communication as epitomized by electronic mail (Email). Email in itself is not an application. It is a kind of utility that allows different applications to run under it. A wide spectrum of applications may be based on an electronic mail system, of which only a small portion has been realized in LAN. One of such applications is to use the Email system for coordinating a multiplicity of interrelated tasks with dispersed participants. However, Email in LAN has encountered many problems. The advantages of Email have been limited in small networks. Since the LAN market in Hong Kong is still in its infancy, most installations are small networks for "trial run" purposes. The

benefits of Email cannot be materialized in such small configurations. Moreover, some of our respondents expressed their disappointment to the existing Email softwares of LAN. The Email products of LAN have to be improved before they are comparable to the Email system in mainframe computers. Email is only a "potential benefit" of LAN.

Communication capability of LAN also contributes to "distributed computing" when installed as a "supplement" to the existing mainframe system. Today in talking about communications, personal computers are pretty much regarded as terminal emulators. But as PC takes on networking function through interconnection in LANs, end users will take advantage of the local processor power of small desk-top computers; and electronic message system will flourish and proliferate. A microprocessor-based workstation with memory capability assures that many of the user's needs can be met at the user's site. This leaves the larger computer free to work on bigger problems, safekeep the user's text and data, store rarely accessed information and thus act as a warehouse of valuable resources. (Advantages of distributed computing will be discussed in a greater depth in the next chapter when compared with centralized multi-user systems)

CHAPTER VII

DISCUSSION: COMPETE FOR THE TEAM COMPUTING MARKET -- LAN VS MULTI-USER SYSTEM

In a team computing environment, LAN has a definite advantage over stand-alone workstations (as discussed in chapter VI). However, LANs encounter another competitor in the team computing market: multi-user systems. Both of them can provide the capabilities of peripheral sharing, information access, and inter-workstation communication. But what are the comparative strengths of LANs over multi-user systems? Under what circumstances will a customer prefer a LAN over a multi-user system?

7.1 Distinctions between LANs and Multi-user Systems

Both LANs and multi-user systems are integrated networks using a common wiring system and common communication protocol to allow communication and resources sharing. From a technical point of view, the significant difference between the two is the type of resources that is shared. In a multi-user system, all users are sharing the "time slices" of a single central processing unit (CPU). Therefore, it is also called a "CPU network". In such kind of systems, performance (in terms of processing time)

deteriorates as more users "sign on" the system. In a LAN, only peripherals are shared among all users who are equipped with their own processing units. Based on this feature, a LAN is also called a "resources network". Its performance drops more slowly than a multi-user system since the bottle-neck lies on disk access (of the central hard disk) rather than the CPU.

From the user's point of view, LANs represent the distribution of functions among a number of devices attached to the LAN while multi-user systems have all functions resided in a central host and all devices attached to that host. Individual users of LANs have higher flexibility in using these functions while multi-user systems have a better control on data security (in terms of access control) on the corporate level.

7.2 Strengths and Weaknesses of the two Systems

7.2.1 Cost

As demonstrated in Exhibit 6.1, multi-user minicomputers require higher initial cost for the central processor and other accessories, while LANs suffer a disadvantage of higher incremental cost. The cost of adding one more terminal to a mini system will be less than the cost of adding one more workstation to a LAN. There will be a "break-even" configuration size (in number of users) above

which the total cost for minicomputer system will be lower than that of LAN. Networking of microcomputers has cheaper cost for smaller configuration but it encounters a cost disadvantage for larger networks.

Of course, as a company continues to add terminals to an existing multi-user system, the service to all users deteriorates as response time increases. In a LAN environment, the response time for each user will be largely unaffected as more workstations are added unless there is heavy contention for hard disk access. Furthermore, additional personal computer workstations would provide additional memory capacity.

Nevertheless, the cost of existing investment is also an important consideration. The out-of-pocket cost of switching completely either from mini systems to the LAN environment or from microcomputers to mini systems will be too high to be justified by any foreseeable benefit.

7.2.2 Performance

In 1980, J.W. Tweedy reported on a comparative analysis that he performed on two alternative team computing system design[1]: (1) a host computer serving dumb

1. In Tweedy's report, he had , in fact, compared four different system configurations. The other two are: (3) a host serving an intermediate cluster processor which in turn served dumb terminals; and (4) the host/cluster processor combination serving intelligent terminals. But only the first and the second system are relevant to our study here. For more details, please refer to:
Tweedy, J.W.,"Comparative analysis of distributed systems designs", in Thurder, K.J. (ed), Tutorial: Office Automation Systems, IEEE Computer Society, 1980, pp. 180-194.

terminals; (2) a host serving intelligent terminals. The second system is similar to the performance of a LAN in terms of distributed processing capability. His result can therefore be used as an indicator of the comparative performance of LANs and multi-user systems.

What his analysis showed was that alternative 1 - host serving dumb terminals - had the lower life cycle cost but had by far the poorer response time. Alternative 2 using intelligent terminals did much better, as far as response time was concerned (Exhibit 7.1 & 7.2).

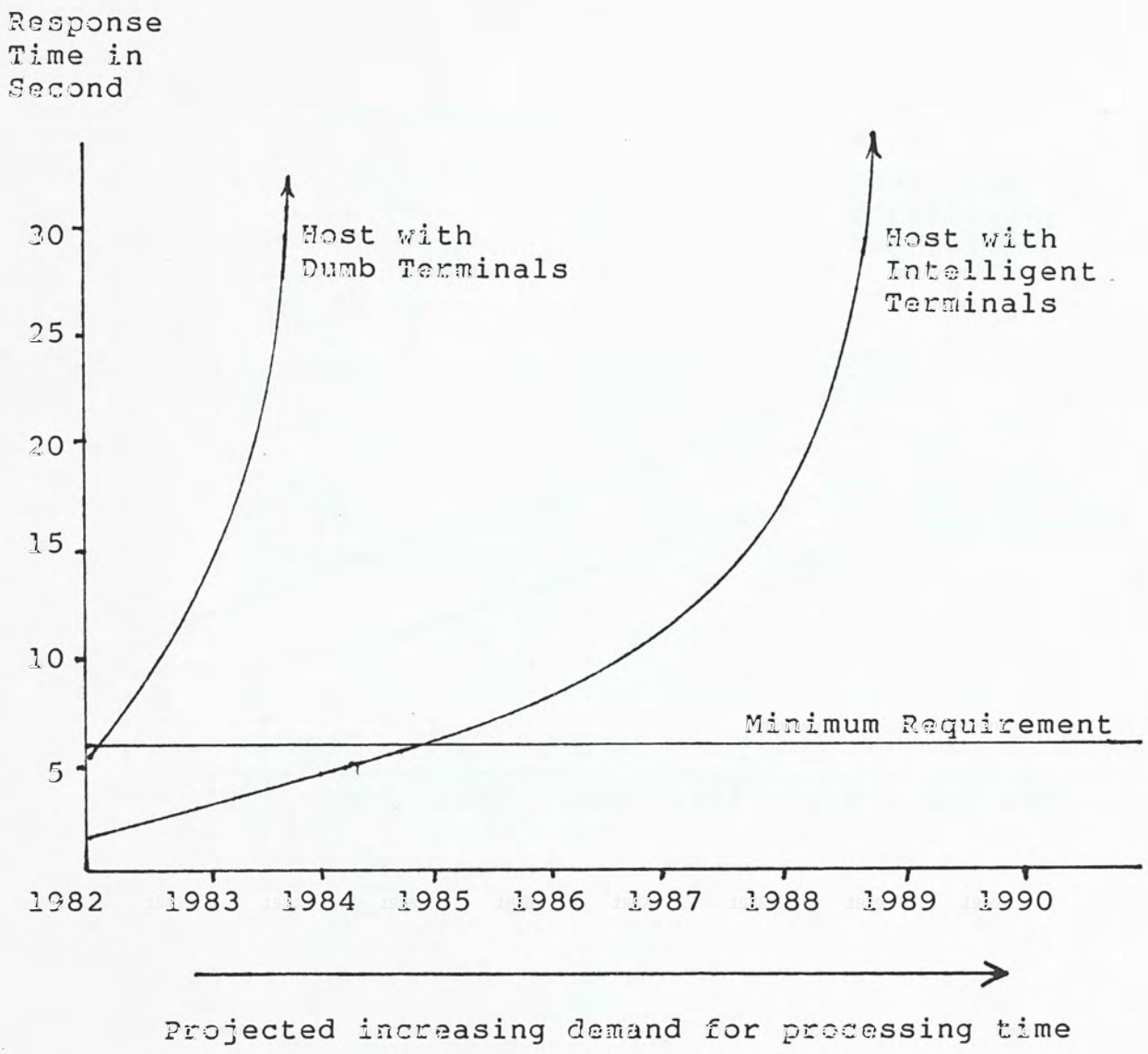
As the computing and processing workload continues to grow at most computer-using organizations, one can expect that the number of terminals/workstations (as well as the number of services requests entered on those terminals) will continue to increase within companies. In addition to this increasing workload, it must be recognized that the work load mix will shift towards requests that consume larger amount of processor cycles. Decision support models, computer graphics, and the use of database management systems will all impose bigger demand on processors.

In such an environment, any type of shared resources will have an increasingly difficult time giving satisfactory response time on processors. LAN, with the advantage of reducing the workload of the central processor, will be more favorable in terms of response time.

There is still another aspect of performance that is important. A workstation's processor can communicate with its own display unit at a much higher speed than a host

EXHIBIT 7.1

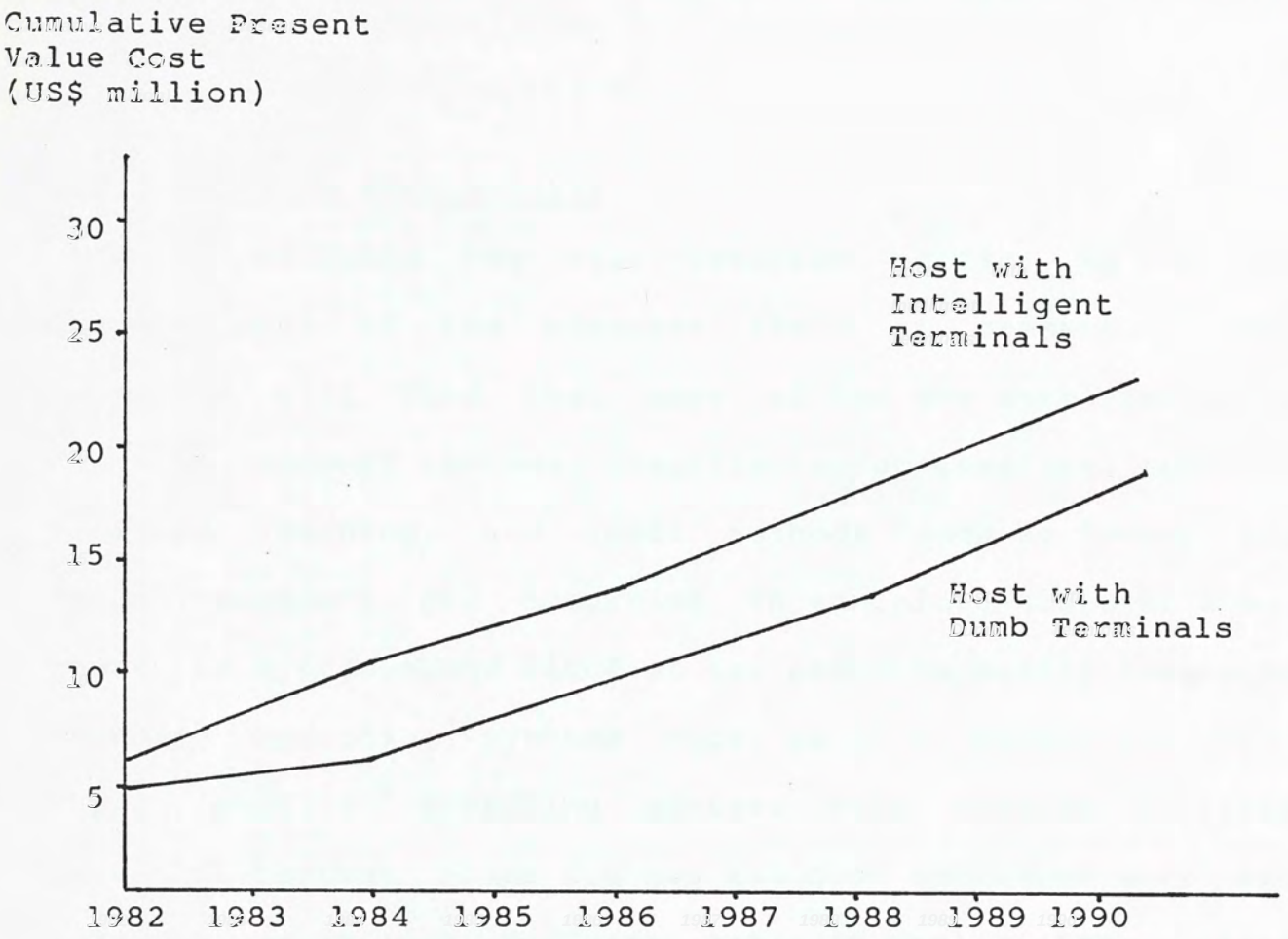
RESPONSE TIME VS THROUGHPUT REQUIREMENT PER YEAR



Source: Tweedy, J.W., "Comparative Analysis of Distributed System Design", in Thurder, K.J. (ed), Tutorial: Office Automation Systems, IEEE Computer Society, 1980, p. 189.

EXHIBIT 7.2

COST VS THROUGHPUT REQUIREMENT PER YEAR



Source: Tweedy, J.W., "Comparative Analysis of Distributed System Design", in Thruder, K.J. (ed), Tutorial: Office Automation System, IEEE Computer Society, 1980, p. 189.

can communicate with a remote terminal. This results in workstations having screen-oriented text editors (not line-oriented editors), on-screen formatting and word-wrap for word-processing, etc., that multi-user systems generally do not offer.

7.2.3 Software Availability

Probably the micro-computer portion is the most dynamic part of the computer field at present. User companies will find that many of the new developments in decision support systems, graphics, color graphics, computer assisted learning, and input methods (such as "mouse" and "touch screen") are occurring in the micro-computer area. There is a tremendous flood of new products mostly involving standard operating systems such as CP/M, MS-DOS and UNIX. These popular operating systems have created a large potential market place for new and good softwares which are able to cater for different areas of applications. Since they are designed for standard operating systems, there is a higher degree of inter-machine compatibility for the programs themselves as well as for the data they use. As a result, standard softwares are easily available for users at relatively low price.

On the other hand, softwares developed for minicomputers are more sophisticated and tailor-made for special applications. Some user companies even need to employ a programming team or hire a software house to develop softwares for their own use. At the same time, the

cost of such softwares is generally much higher than those standard packages of micro-computers. Since these softwares are specially designed for particular machines or particular applications, the system maintenance cost should also be higher than standard packages.

There is a trade-off in software availability. Softwares for micro-computers are cheaper and more user-friendly for those routine jobs common to all users. LAN takes the advantage of standard packages, already had a rich base of software available. Minicomputers can provide softwares for special and complicated tasks that can be customized to unique conditions of the users. But the variety is more limited due to machine compatibility and the price is generally higher.

7.2.4 Data Security and Control

Multi-user minicomputers usually have a security protection feature built into its operating system or "firmwares". Users have to go through a process of hierarchical control and password checking devices in order to access authorized data. However, the server softwares of LAN (e.g. EtherShare) have to be run on a standard operating system (e.g. MS-DOS). The security protection feature claimed by LAN producers can only function under the control of these server softwares. An user (particularly the user of the workstation dedicated as network server) can skip the server software and access the confidential data directly through the operating system. No single brand of LAN can check against such unauthorized access.

Moreover, a network of micro-computers provides options of local diskette drives so that data and programs can be easily copied into floppy disks. Removable disks make it easy for someone to take copies of valuable programs and data off-premises.

The distributed computing feature of LAN opens the door for violation of company policies regarding information control. Workstations with local storage raise the possibility that staff will create and maintain their own records about confidential information of the company. This possibility seems more likely with workstations than it does with dumb terminals of minicomputers. It is because local staff might well feel that they can hide this information with their own local storage.

7.2.5 System Flexibility

One of LAN's major advantages is its modular extensibility. LAN permits smooth growth in computing resources. Servers can be added as existing servers become overloaded or as the cost of special peripherals, such as laser printers, becomes justifiable.

Modular extensibility allows user organizations to stay closer to the forefront of technology. As long as a new computing facility meets the user company's standard for operating system and communication, the chances are fairly good that it can be attached to a local network within the company without much difficulty. Suppliers are seeking to provide this compatibility. New technology can therefore be added when and where it is most needed, in small increments.

With terminals tied to a multi-user minicomputer, much higher cost and bigger effort are involved in switching over to new technology. Sometimes, it even needs to replace the whole computer and operating system.

7.2.6 Product Life Cycle

Local area network is a product in the "product introduction" stage of its product life cycle. There is no commonly accepted standard among different brands of LANs. Furthermore, a LAN requires a lot of hardware accessories with "plug-in" compatibility to the system. The history of development for such kind of accessories is relatively short as compared to minicomputers. As a result, LANs suffer from a disadvantage of lower hardware reliability (no matter it is true or not, LAN has an image of being less reliable to most potential users). Prospective users hesitate to use LAN due to the fear of "system down", though no such complaint had been reported by our respondents from the user companies. With such a feeling, a user who decides to install a LAN is, to a certain extent, taking a risk.

Minicomputer systems have evolved into its early mature stage. All the required hardware have been tested, improved and redesigned a lot of times. The technology of minicomputers is more sophisticated and more reliable. As a result, people generally perceive minicomputer with higher degree of hardware reliability. This image gives more confidence to potential users.

7.3 Users' Consideration

After considering the comparative strengths and weaknesses of LANs, we come to face with a question: what would be the major considerations of a potential user in choosing between LAN and multi-user minicomputer?

7.3.1 Distributed Computing vs Centralized Control

The company's control philosophy becomes a concern here. An organization pursuing distributed computing environment will choose LAN while a centralized control company would prefer multi-user systems due to its better security protection.

7.3.2 Process of Office Automation

If an organization is undergoing a "bottom-up" computerization process (i.e. install computer facilities for each department first and then integrate them into an interrelated system), it would be more likely that different brands of facilities have been installed in different sub-units of the company. LAN is more suitable to integrate such a wide variety of facilities into a network.

If "top-down" computerization process has been adopted, multi-user mini- or mainframe systems are more likely to provide economy of scale and internal compatibility.

7.3.3 Sunk Cost

It is a natural tendency that customer's decision would be affected by what have been installed. If the

organization has already invested a considerable amount of money on micro-computers, LAN is the cheapest method to connect the existing workstations. Otherwise, minicomputer would be more cost-effective if it was planned from the beginning.

The above users' considerations conclude this chapter. The first and the third dimensions will be explored in greater detail in the next chapter.

CHAPTER VIII

DISCUSSION: CUSTOMER PROFILE

From the analysis in chapter V, we have identified five dimensions that are important characteristics of "high-potential users". These dimensions are: 1) Corporate control philosophy; 2) Company size; 3) Sunk cost invested; 4) Resources utilization rate; and 5) Nature of computer jobs. These results have attracted our attention to the effect of internal operating environment on decision makers to adopt local area networks. In this chapter, we try to explain why these characteristics are associated with high-potential users and explore what the needs of these high-potential users are.

8.1 Corporate Control Philosophy

Since local area networks have an inherent structure for distributed computing, it is a logical deduction that corporate control philosophy will definitely affect the purchasing decision.

A distributed computing system has the advantages of:

1. Reduced pressure on the central computer;
2. More flexible and tailor-made applications and data structure;

3. Improved response time and turnaround time;
4. Lessened flow of paperwork;
5. More convenient and immediate access to information;

But it also has a lot of disadvantages:

1. Potential for a loss of consistency in the data and information format;
2. Unnecessary duplication of information may occur;
3. Difficulty in protecting confidential information from unauthorized access;

Whether these trade-offs can be justified depends on the company's concern for management control. From our survey findings, those companies which are not satisfied with their existing data control system are less likely to use LAN (Exhibit 8.1). It is because minicomputer systems generally have a better security control than LAN. One of our respondents confirmed that the concern for data control was the main reason of his company to install an IBM System 36 rather than a PC Network. The decision was not based on cost concern since the system only has 10 terminals (in such a small configuration, LAN would be more cost-effective). Rather than dumb terminals, all the workstations consist of an IBM PC equipped with a printer. This configuration gives evidences that the major consideration is not cost, but data security.

Local Chinese business establishments usually adopt a centralized hierarchical control structure. It is expected that these firms will prefer minicomputers over LANs in their computerization process. Our survey data

EXHIBIT 8.1

OPINION TO PRESENT DATA SECURITY BY POTENTIAL GROUPS

Potential to Use LAN	Opinion to Existing Data Security	
	Satisfied	Not Satisfied
High Potential	3 (15%)	12 (46%)
Low Potential	17 (85%)	14 (54%)
Total	20	26

EXHIBIT 8.2

CAPITAL ORIGIN BY POTENTIAL GROUPS

Potential to Use LAN	Capital Origin	
	Local based	Foreign Owned
High Potential	7 (26%)	8 (42%)
Low Potential	20 (74%)	11 (58%)
Total	27	19

indicate that a much higher percentage of foreign-owned business firms is classified as the "high-potential" group (i.e. 42% compared with 26% of local establishments, Exhibit 8.2).

8.2 Company Size

Chapter V showed that company size has a positive association with customer potential. This is confirmed by Exhibit 8.3 which shows that the average size for the high potential group is 1089 employees while that for the low potential group is only 404. There is a significant difference between the two groups.

There are several reasons contributing to this phenomenon. First of all, large firms have more money to spend on trying out new ideas. LAN is a product newly introduced into Hong Kong. Many potential users are not aware of its benefits and weaknesses (or even unaware of such a product). There is no commonly accepted standard of configuration in the LAN industry. As a result, investment on LAN is actually a risk-taking decision. Large business firms with their larger budget on EDP (Exhibit 5.3) are able to afford the risk of adopting new technology. Information from our interviews with user-companies indicates that they employ the LANs mostly for development or evaluation purposes (whether it can be installed in large scale throughout the organization) rather than operational usage. On the other hand, smaller firms do not want to (and cannot afford to) commit too early in LAN.

EXHIBIT 8.3

AVERAGE NUMBER OF EMPLOYEES AND SYSTEM SUPPORT STAFF BY POTENTIAL GROUPS

Average Number of ...	Potential to use LAN: High(1)	Low(2)	Difference (1-2)	F value[1]
Employees	1089.9	403.9	685.0	5.86
System Support Staff	24.1	14.7	9.4	3.26

Another explanation is also related to the product infancy. The complexity of this new product coupled with the image of low hardware reliability has created a great deal of uncertainty among the users so that they must have some knowledge about LAN before they make the decision to implement a LAN. Therefore, an internal system support team is a necessary condition to make the users feel more confident to local area networks. Exhibit 8.3 shows that the average number of internal system support staff is generally larger for the high potential group than that of the low potential group.

1. F value is a statistics measuring the proportion of the dependent variable's variance which can be explained by the group difference. In other words, the larger the F value, the less likely that the group differences are due to random variations.

8.3 Sunk Cost

While large corporations are less conscious about the price of LAN, the cost of existing facilities installed becomes more critical. The number of PCs and printers are the two most important discriminating criteria in the analysis in chapter V. Exhibit 8.4 further proves the significant differences of installed facilities between "high potential" and "low potential" groups. On the other hand, the investment on dumb terminals and disk drives are insignificant in the discriminant function (Exhibit 5.8). These results converge to a conclusion that decision makers will consider the sunk cost invested on microcomputers since a LAN connecting the existing PCs is much more cost effective than implementing a new mini system.

Companies without a long-term plan of computerization usually adopt microcomputers in small increments. Flexibility becomes the most important concern for these companies. Large organizations do not necessarily have better plans on computerization. In fact, a small company is easier to have a comprehensive plan on computer facilities due to the simplicity of small configurations. Education institutions (universities, colleges) are good examples of large organizations with bottom-up computerization process because of their highly decentralized structure.

EXHIBIT 8.4

AVERAGE NUMBER OF PCs, PRINTERS AND PLOTTERS

BY POTENTIAL GROUPS

Average Number of ...	Potential to use LAN			
	High(1)	Low(2)	Difference (1-2)	F value
PCs	22.1	5.6	16.5	3.15
Printers	26.8	5.6	21.2	10.30
Plotters	1.3	0.2	1.1	4.02

8.4 Facility Utilization Rate

Resources sharing is the major advantage of LAN. As a result, those organizations with under-utilized resources (especially printers and hard disk drives) are more likely to use LAN in order to have a better use on these resources. However, since the potential customers are mainly large companies who are less cost-conscious, this factor ranks relatively low among others (in the discriminant analysis, printer utilization rate ranks fourth and disk utilization is the least important factor in the list). But it cannot be denied that this is one of the

factors affecting the decision makers.

Exhibit 8.5 shows that printer utilization for high potential group is significantly lower than that of low potential group. For disk utilization, the relation is not very clear. It is probably because the average utilization of hard disk is quite high (66.1% for the entire sample) as compared with that of printers (41.7%).

EXHIBIT 8.5

RESOURCES UTILIZATION RATE BY POTENTIAL GROUPS

Average Percent of ...	Potential to use LAN			
	High(1)	Low(2)	Difference (1-2)	F value
Printer Utilization	35.3%	44.8%	-9.5%	1.42
Disk Utilization	65.2%	68.2%	-3%	0.02

8.5 Nature of Computing Tasks

The writers have hypothesized that different nature of tasks would affect the potential of using LAN. It is because LAN has an advantage of information sharing and different types of jobs have different demand on shared information. For instance, word processing usually needs a stand alone workstation with a quality printer. However, data base management requires a communication capability of different workstations to share the same data base.

Our discriminant analysis has extracted database management and system maintenance/programming among others, as two discriminating factors (Exhibit 5.8). Exhibit 8.6 compares the average share of computer time allocated to five types of operations. It reinforces our prior analysis that high potential users significantly allocate more time on data base management and system maintenance/programming. Word processing and data processing/calculation are more likely to associate with low potential users.

This result is consistent with our hypothesis since data base management needs information sharing while programming can be performed better with shared software (e.g. programming tools).

8.6 Implications on Customer Needs

The implications of these results are that those potential users (at least at this stage) are purchasing LAN

EXHIBIT 8.6

SHARE OF COMPUTER TIME ON DIFFERENT TYPES OF JOBS

BY POTENTIAL GROUPS

Average Percent of Time for ...	Potential to use LAN			
	High(1)	Low(2)	Difference (1-2)	F value
Word Processing	19.3%	21.8%	-2.5%	0.16
Communication	9.3%	4.5%	-4.8%	2.28
Data Base Management	15.7%	11.7%	4%	0.60
Data Processing/ Calculation	29.7%	41.8%	-12.1%	2.60
System Maintenance/ Programming	25.1%	16.7%	8.4%	2.93

for future needs. They are not the cost-conscious group so that price competition is not a good marketing strategy. Instead, their major concern would be the potential use of LAN in future. After-sale services including system consultancy, hardware maintenance, product enhancement, and software development are the important needs of these large corporations. It is important that these large corporations have a high potential to extend their use of LAN in future. Both dealers and manufacturers should pay attention to this "continuous deal" and cooperate to improve the product, especially in the areas of response time, security, and compatibility (obviously, these improvements must have vertical compatibility with their predecessors).

CHAPTER IX

CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

As the writers have expected, the local area network industry of Hong Kong is still in its infancy. There are many supporting facts for arriving at such a conclusion. First of all, there are not many current LAN users in Hong Kong. A majority of the business firms still do not even know what a LAN is and they are generally unaware of the concept and benefits of LAN.

The distributors and dealers of LANs should partly be blamed in this aspect. They have not done enough to educate the public about LANs. In fact, almost every LAN user has certain degree of knowledge in LAN before he decides to install LAN. The dealers just take a rather inactive role in promoting LAN. Instead of approaching the potential customers aggressively, they choose to sell LANs by establishing good connections with software houses. Such an indirect selling process, in the writers' opinion, is not very effective.

There also is not a standardized LAN product, which fully satisfies the ISO/OSI model as described in Chapter II, available in the market. Such a lack of standard makes business firms to hold on their investment on

LANs. They simply do not want to risk a considerable amount of money on a product which the life span cannot be determined. As a matter of fact, all the potential users in the market are still waiting for the IBM Token Ring LAN to come to Hong Kong.

The writers originally believed that LAN would look more attractive to smaller firms. The LAN dealers also told us their target market should be these firms. However, it is interesting to see that most of the current LAN users are larger business organizations. They install LANs mainly for evaluation purposes rather than operational use. Again such a phenomenon indicates the LAN industry is still in the developing stage in Hong Kong.

As far as competition is concerned, the major competitor of LAN is mini-computer system. A lot of the business firms which have the potential to become LAN users have already installed mini-computer systems. Moreover, business firms which have a long-term plan on office automation and start with no micro-computers in hand will usually go for mini-computers instead of LANs. The data security problem also hinder the marketing of LANs in Hong Kong.

LANs do have certain unique selling points. As the personal computer population of Hong Kong has grown dramatically in the past few years, the demand for connecting these stand-alone workstations is rather high. The flexibility of LANs should be most appealing to those firms which cannot forecast the demand for computing

facilities in the future accurately. In fact, companies with a few personal computers in hand will find LAN attractive because of cost considerations.

In view of the above findings, the writers believe that Hong Kong is only in the early conception stage for local area networks. There is high potential in the market but it has not been reached. As more people are becoming aware of LANs and standardized LAN products come into the market, the number of LAN users will certainly increase.

9.2 Recommendations

In order to expand the market for LAN in Hong Kong, the dealers should change their strategies. As the LAN industry is still rather immature in Hong Kong, the dealers should in the short-run change their target market from small business firms to larger ones. Larger firms will be more interested in trying out new ideas. More importantly, they have the money to do experiments. Perhaps in a later stage when the product becomes mature should the dealers switch to smaller firms again.

The distribution channel of the LAN dealers is very inefficient. Selling LANs to customers through software houses will only confine the potential users to a very small number. It is necessary for the dealers to take the initiative to approach the potential users in a more aggressive way. The writers would like to stress that the success of personal selling means identifying the customer needs, not understanding technical details. The dealers

should act like a consultant who provides solutions to the potential customers rather than selling them LAN products.

More promotion is needed to create the awareness of the potential customers. Advertisements should no longer only be placed in computer magazines, but in business magazines and newspapers so as to attract the attention of the public. More exhibitions and seminars should also be provided to arouse the interest of the potential customers. The dealers must remember that these promotional events should be customer oriented rather than technically inclined.

Many dealers are afraid of the potential threat from the IBM Token Ring LAN. The writers do not agree with such a pessimistic point of view. With the introduction of Token Ring in the LAN market, there is going to be heavy promotion done by IBM. More people will then know more about LAN and gain confidence in it because IBM also offers LAN products. We therefore believe the invasion of Token Ring will only expand the market size, not eating away the existing share. Actually, the dealers can make use of such an opportunity to expand their market shares as well.

At the present stage the LAN products are still not as well developed as the mini-computers. The LAN dealers should therefore avoid head-on competition with them. The dealers should try to find a market segment where flexibility is the most important concern. They should also avoid approaching potential customers who has a long term plan in office automation and concern very much about data security.

The above recommendations are based on the writers' research findings. Due to limited resources and lack of published statistics, the findings may not be very representative. However, the writers strongly believe that these recommendations should provide some insight to the dealers of the LAN industry in Hong Kong.

BIBLIOGRAPHY

1. Bevan, Mike: "Corporate Networking and the PC", Data Processing, Vol.27 No.7, Sept. 1985, pp.17-20.

2. Birenbaum, Larry: "The IBM PC Meets Ethernet", BYTE, Nov. 1983.

3. Bryant, Susan F.: "LANs vs Multi-User Systems: Which is Best for Team Computing?", Computer Decisions, Oct. 1984, pp.113-130.

4. Chester, Jeffrey: "Resource Sharing: The Promise of Local Area Networks", Infosystem, March 1985, pp.56-58.

5. Chorafas, Dimitris N.: Computer Networks for Distributed Information Systems, Petrocelli Books Inc., 1980.

   Designing and Implementing Local Area Networks, McGraw-Hill, 1984.

6. Dickinson, John: "LAN Speed Trials", PC Magazine, Feb. 1985.

7. Hecht, Jeff: "Fiber Optics Light up Networks", PC Magazine, March 5, 1985, pp.169-175.

8. MacCallum, Jeff: "Local Area Networks: Putting it all together", Management Technology, August, 1984, pp.45-56.

9. Mayo, John: "PC Network Automates Office: Mini Features at Micro Cost", Communication Engineering & Design, June 1984, pp.73-79.

10. Miles, J.B.: "LAN Slide? Plateau in the LANscape", Computer Decisions, June 1985, pp.90-100.

11. Morrison, Donald G.: "Discriminant Analysis", in Robert Ferber ed., Handbook of Marketing Research, New York:McGraw-Hill, 1974.

12. Moy, David K.: Data Communications & Data Storage Purchase Recommendation, Morgan Stanley Investment Research, Sept. 1984.

13. Norman, E. Nie, et al.: Statistical Packages for the Social Sciences, McGraw-Hill, 2nd ed. 1975.

14. Pitt, D.A. "The Distribution of Functions in Local Area Networks of Personal Computers", Hong Kong Computer Journal, Vol.1 No.11, Nov. 1985, pp.13-18.

15. Richardson, Ted: "Future for Corporate Networks", Data Processing, Vol.27 No.6, July/August, 1985, pp.37-40.

16. Stix, Gary: "Is there a PBX to the promised LAN?", Computer Decisions, March 26, 1985, pp.98-108.

17. Tweedy, James W.: "Comparative analysis of Distributed System Design", in Thurber, Kenneth J. ed., Tutorial: Office Automation Systems, IEEE Computer Society Press, 1980, pp.180-193.

18. Wright, Jim: "Computer are Communicating -- via Networks", Engineering Computers, Jan 1984, pp.20-25.

19. Annual Report, 3Com Corporation , 1985.

20. "Basic Technology of Local area Networks", Computronics, May 1984, pp. 102-109.

21. Hong Kong Trade Statistics, Hong Kong Government, 1983, 1984 & 1985.

22. "LANs: The Promise and the Payoff", Computer Decisions, April, 1984, pp.92-110.

23. "LAN Speed Trials", PC Magazine, Feb. 1985, pp.168-170.

24. "Networks: How do they compare?", MicroDecision, Sept. 1985, pp.18-22.

25. "Network Survey: 3COM EtherSeries", PC Magazine, Feb. 1985, pp.180-186.

26. "When You Need a Multi-user System", MicroDecision, Nov. 1985, pp.18-22.

INTERVIEWS

1. January 17, 1986: Mr. I. Lee, COMPAC Microelectronics (HK) Ltd.

2. January 23, 1986: Mr. E. Chang, Convergent Microsystems (HK) Ltd.

3. January 25, 1986: Mr. M.T. Au, Hong Kong Electric.

4. January 28, 1986: Mr. A. Yue, DataLink Computer Systems Ltd.

5. February 17, 1986: Mr. Y.W. Ho, Hong Kong Air Cargo Terminal Ltd.

Note: This list of interviews is not exhaustive. There were some respondents who would like to keep their names confidential so that their names are not listed here.

APPENDIX A

INTERVIEW GUIDE -- LAN DISTRIBUTORS AND DEALERS

1) Which brands of local area networks is your company promoting in Hong Kong?

2) Can we get the catalog, price-lists and brochures?

3) Who are the customers of your company? Does your company have clearly defined target markets?

4) How does your company decide who your potential customers are? Are the potential customers well-informed of the many advantages which a local area network can provide?

5) How does your company sell the products? For example, through advertising where potential customers call you up or through personal selling. In other words, is your company playing an active or passive role when selling the products?

6) Can you estimate the total number of LANs installed in Hong Kong? How large is the market share of your network(s) in the Hong Kong LAN market?

7) What are the major problems encountered in the marketing of the networks?

8) What are the comparative advantages of your network(s) over other networks?

9) Who are your competitors?

10) Are there substitutes for LANs? For example, minicomputers.

11) What do you think of the prospect of LANs in Hong Kong?

12) What are the criteria to evaluate the performance of your network(s)? What are the changes in performance when more workstations are installed?

13) What is the cost per workstation for 10, 20 and 30 workstations? (including the interface card, cabling and implementation cost) Can you give us a quotation list?

14) What are the control mechanisms built into your network(s) to ensure data security?

15) Can you provide us with a list of some of the end-users who have installed LANs?

APPENDIX B

INTERVIEW GUIDE -- LAN USERS

1. Would you tell us the background of your company? Business Nature? Company size? Capital origin? Number of employees using computer facilities?

2. Which brand of LAN has your company installed?

3. How many workstations are linked up by the LAN?

4. How much does the LAN cost?

5. What are the main reasons of installing the LAN?

6. Which of the following aspects of LAN does your company consider most important? Cost? Standardized product? Data security?

7. Which of the following features of LAN is most helpful to your company? Sharing of a common database? Sharing of expensive peripherals? Electronic communication?

8. What do you think of the performance of the LAN your company has installed?

9. What are the major objections from the people working with the LAN?

10. Where did you obtain the information about LAN before installation? Advertisements, dealers, software houses or own staff?

11. Through what channel did you buy the LAN? Dealer? Software house?

12. Can you give a demonstration on your LAN?

APPENDIX C

SURVEY QUESTIONNAIRE

I. Background Information

1) What type of business is your company engaged in? (Please check the single most appropriate type)

_____ Finance/Accounting (excluding licensed banks)
_____ Banking (licensed bank)
_____ Construction/Property
_____ Trading
_____ Manufacturing
_____ Communication
_____ Tourism
_____ Others (please specify) _____

2) What is the approximate office area of your company in square feet?

_____ sq. ft.

3) Approximately how many employees are in your company?

_____

4) Your company is

_____ Locally owned
_____ Foreign based (please specify: U.S., British, Japanese etc. _____)

5) Please give an approximation of the total revenue (in million HK$) of your company last year.

_____ 1 or below
_____ >1-5
_____ >5-20
_____ >20-50
_____ >50-100
_____ >100

II. Computer Facilities

1) Please indicate the major type of computer system being used in your company. (Please check the dominant one)

_____ Mainframe system
_____ Multi-user mini-computer system
_____ Micro-computers

2) Please give a list of major suppliers of computer facilities (in descending order of importance) in your company. (e.g. IBM, DEC, WANG etc.)

a) _____
b) _____
c) _____
d) _____

3) Please give an approximation of the budget allocated to data processing (including hardware, software and manpower expenses) and internal computer service support in your company last year. (in HK$)

_____ 100,000 or below
_____ >200,000-500,000
_____ >1,000,000-5,000,000
_____ >100,000-200,000
_____ >500,000-1,000,000
_____ >5,000,000

4) Please indicate the total number of each of the following items in your company.

a) Terminals linked to a central processor: _____ terminals
b) Stand-alone personal computers: _____ sets
c) Printing devices: Printers: _____ sets
Plotters: _____ sets
d) Storage devices: Total no. of harddisks: _____ sets
Total storage capacity: _____ M bytes
% occupied by data and programs: _____ %

5) Does your company plan to expand the computer facilities in the next 2 years?

a) Terminals: _____ sets
b) Personal computers: _____ sets
c) Harddisks: _____ sets for a capacity of _____ M bytes
d) Processing units (e.g. minicomputers, multi-user processors): _____ units

III. Computer Operations

1) Approximately how many employees in your company are responsible for providing internal computer service support?

_____

2) Please estimate the % of total employees who would use computers in their daily operation.

_____ %

3) Please estimate the % of time (office hours) when your terminals/PCs are in use.

____ 0-20% ____ 21-40% ____ 41-60% ____ 61-80% ____ 81-100%

4) Please estimate the % of time (office hours) when your printers are printing.

____ 0-20% ____ 21-40% ____ 41-60% ____ 61-80% ____ 81-100%

5) What is your opinion to the data security (against unauthorized access) in your current computer system?

_____ excellent _____ good
_____ satisfactory _____ poor
_____ no control at all

6) Please estimate the % of time that computer facilities in your company be used for the following activities.

Word processing and reporting:	_____ %
Electronic communication:	_____ %
Data base management:	_____ %
Data processing and calculation:	_____ %
Programming and system maintenance:	_____ %
Other activities (please specify _____):	_____ %
total =	100 %

7) Do you consider the following computer facilities adequate?

	Inadequate 1	2	3	4	adequate 5
a) CPU processing time	( )	( )	( )	( )	( )
b) Printing facilities	( )	( )	( )	( )	( )
c) Storage capacity	( )	( )	( )	( )	( )
d) Communication capability	( )	( )	( )	( )	( )

8) Is your company a user of: (can check more than one item)

a) Local Area Network _____ (please proceed to IV.1)
b) Multiuser Minicomputer System _____ (please proceed to IV.2)
c) None of the above _____ (please proceed to IV.3)

IV.1 For users of LANs

1. Which brand of Local Area Network your company is using? (e.g. Ethernet, Omninet etc.)

_____

2. How many workstations are linked by the LAN? _____

3. What is the installation cost (including hardware, software and cabling) per workstation of your LAN?

HK$ _____

4. Are you satisfied with the performance of your LAN?

_____ excellent
_____ average
_____ very poor
_____ good
_____ not satisfactory

IV.2 For users of multi-user mini-systems

1. Which brand of multi-user system your company is using?

_____

2. How many terminals are linked to your system? _____

3. What is the installation cost per terminal of your multi-user system?

HK$ _____

4. Are you satisfied with the performance of your multi-user mini-system?

_____ excellent
_____ average
_____ very poor
_____ good
_____ not satisfactory

VI.3 For non LAN and multi-user mini-system users

1. Can you estimate the probability that your company will install a Local Area Network or a Multiuser Minicomputer in the next 2 years?

	Impossible 1	2	3	4	Very likely 5
a) Local Area Network	( )	( )	( )	( )	( )
b) Multi-user Mini-computer	( )	( )	( )	( )	( )

APPENDIX D: TABULATION OF SURVEY RESULTS

Question I.1: Industry

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Banking(licensed bank)	2	5	10.9	10.9	10.9
Construction Property	3	3	6.5	6.5	17.4
Trading	4	15	32.6	32.6	50.0
Manufacturing	5	10	21.7	21.7	71.7
Communication	6	2	4.3	4.3	76.0
Computer Related	8	8	17.4	17.4	93.4
Others	0	3	6.5	6.5	100.0
	TOTAL	46	100.0	100.0	

MEAN	4.457	STD DEV	2.147	MINIMUM	.000
MAXIMUM	8.000				
VALID CASES	46	MISSING CASES	0		

- -

Question I.2: Office Area (Sq. ft.)

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
in thousand sq. ft.	1	2	4.3	4.9	4.9
	2	1	2.2	2.4	7.3
	3	1	2.2	2.4	9.8
	4	4	8.7	9.8	19.5
	5	2	4.3	4.9	24.4
	7	2	4.3	4.9	29.3
	8	3	6.5	7.3	36.6
	10	3	6.5	7.3	43.9
	11	1	2.2	2.4	46.3
	15	3	6.5	7.3	53.7
	17	1	2.2	2.4	56.1
	25	1	2.2	2.4	58.5
	30	2	4.3	4.9	63.4
	32	1	2.2	2.4	65.9
	35	1	2.2	2.4	68.3
	40	1	2.2	2.4	70.7
	43	1	2.2	2.4	73.2
	50	2	4.3	4.9	78.0
	60	1	2.2	2.4	80.5
	100	2	4.3	4.9	85.4
	150	1	2.2	2.4	87.8
	180	1	2.2	2.4	90.2
	200	1	2.2	2.4	92.7
	300	1	2.2	2.4	95.1
	400	1	2.2	2.4	97.6
	500	1	2.2	2.4	100.0
	999	5	10.9	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	60.951	STD DEV	109.671	MINIMUM	1.000
MAXIMUM	500.000				
VALID CASES	41	MISSING CASES	5		

APPENDIX D (continue ...)

Question I.3: Number of Employees

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	10	2	4.3	4.4	4.4
	18	1	2.2	2.2	6.7
	20	2	4.3	4.4	11.1
	23	1	2.2	2.2	13.3
	25	2	4.3	4.4	17.8
	30	2	4.3	4.4	22.2
	40	2	4.3	4.4	26.7
	45	1	2.2	2.2	28.9
	50	1	2.2	2.2	31.1
	60	1	2.2	2.2	33.3
	74	1	2.2	2.2	35.6
	110	1	2.2	2.2	37.8
	120	1	2.2	2.2	40.0
	160	1	2.2	2.2	42.2
	180	1	2.2	2.2	44.4
	200	1	2.2	2.2	46.7
	250	1	2.2	2.2	48.9
	280	1	2.2	2.2	51.1
	350	2	4.3	4.4	55.6
	380	1	2.2	2.2	57.8
	450	1	2.2	2.2	60.0
	500	6	13.0	13.3	73.3
	600	1	2.2	2.2	75.6
	800	1	2.2	2.2	77.8
	1000	1	2.2	2.2	80.0
	1200	1	2.2	2.2	82.2
	1400	2	4.3	4.4	86.7
	1500	1	2.2	2.2	88.9
	1700	1	2.2	2.2	91.1
	2000	1	2.2	2.2	93.3
	2500	1	2.2	2.2	95.6
	4000	2	4.3	4.4	100.0
	9999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN 632.222 STD DEV 943.185 MINIMUM 10.000
MAXIMUM 4000.000

VALID CASES 45 MISSING CASES 1

APPENDIX D (continue ...)

Question I.4: Capital Origin

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Locally Owned	1	27	58.7	58.7	58.7
U.S.	2	8	17.4	17.4	76.1
British	3	5	10.9	10.9	87.0
Japan	4	2	4.3	4.3	91.3
China	6	4	8.7	8.7	100.0
	TOTAL	46	100.0	100.0	

MEAN	1.957	STD DEV	1.520	MINIMUM	1.000
MAXIMUM	6.000				
VALID CASES	46	MISSING CASES	0		

- -

Question I.5: Last Year Revenue

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
$1 m. or below	1	2	4.3	5.0	5.0
>$1 m. to $5 m.	2	2	4.3	5.0	10.0
>$5 m. to $20 m.	3	6	13.0	15.0	25.0
>$20 m. to $50 m.	4	3	6.5	7.5	32.5
>$50 m. to $100 m.	5	4	8.7	10.0	42.5
>$100 m.	6	23	50.0	57.5	100.0
	9	6	13.0	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	4.850	STD DEV	1.594	MINIMUM	1.000
MAXIMUM	6.000				
VALID CASES	40	MISSING CASES	6		

- -

Question II.1: Major of Computer System in Use

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Mainframe	1	18	39.1	39.1	39.1
Minicomputer	2	19	41.3	41.3	80.4
Microcomputer	3	9	19.6	19.6	100.0
	TOTAL	46	100.0	100.0	

MEAN	1.804	STD DEV	.749	MINIMUM	1.000
MAXIMUM	3.000				
VALID CASES	46	MISSING CASES	0		

APPENDIX D (continue ...)

Question II.2: Major Supplier of Computer Facility

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
IBM	1	18	39.1	40.9	40.9
NCR	3	1	2.2	2.3	43.2
DEC	4	5	10.9	11.4	54.5
Hitachi	5	3	6.5	6.8	61.4
Sperry	6	1	2.2	2.3	63.6
Cromemco	7	1	2.2	2.3	65.9
Datapoint	8	1	2.2	2.3	68.2
Burroughs	9	2	4.3	4.5	72.7
Micro-Data	10	1	2.2	2.3	75.0
Micro Voice	11	1	2.2	2.3	77.3
Tandy	12	1	2.2	2.3	79.5
Alpha Micro Prime	13	1	2.2	2.3	81.8
Perkin Elmer	14	3	6.5	6.8	88.6
NEC	15	1	2.2	2.3	90.9
Hewlett Packard	16	1	2.2	2.3	93.2
Develcon	17	1	2.2	2.3	95.5
Bondwell	18	1	2.2	2.3	97.7
Wang	19	1	2.2	2.3	100.0
	99	2	4.3	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	6.091	STD DEV	5.782	MINIMUM	1.000
MAXIMUM	19.000				
VALID CASES	44	MISSING CASES	2		

- -

Question II.3: Budget for EDP

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
$100,000 or below	1	8	17.4	18.6	18.6
>$100,000 to $200,000	2	2	4.3	4.7	23.3
>$200,000 to $500,000	3	10	21.7	23.3	46.5
>$500,000 to $1,000,000	4	4	8.7	9.3	55.8
>$1,000,000 to $5,000,000	5	13	28.3	30.2	86.0
>$5,000,000	6	6	13.0	14.0	100.0
	9	3	6.5	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	3.698	STD DEV	1.712	MINIMUM	1.000
MAXIMUM	6.000				
VALID CASES	43	MISSING CASES	3		

APPENDIX D (CONTINUE ...)

Question II.4a: Total Number of Terminals

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	5	10.9	11.1	11.1
	1	2	4.3	4.4	15.6
	2	1	2.2	2.2	17.8
	3	1	2.2	2.2	20.0
	4	2	4.3	4.4	24.4
	5	2	4.3	4.4	28.9
	6	2	4.3	4.4	33.3
	8	3	6.5	6.7	40.0
	9	1	2.2	2.2	42.2
	10	4	8.7	8.9	51.1
	11	1	2.2	2.2	53.3
	14	1	2.2	2.2	55.6
	17	1	2.2	2.2	57.8
	20	2	4.3	4.4	62.2
	22	3	6.5	6.7	68.9
	26	1	2.2	2.2	71.1
	40	2	4.3	4.4	75.6
	46	1	2.2	2.2	77.8
	50	1	2.2	2.2	80.0
	60	2	4.3	4.4	84.4
	63	1	2.2	2.2	86.7
	70	1	2.2	2.2	88.9
	80	1	2.2	2.2	91.1
	100	1	2.2	2.2	93.3
	148	1	2.2	2.2	95.6
	150	1	2.2	2.2	97.8
	300	1	2.2	2.2	100.0
	999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	33.133	STD DEV	54.285	MINIMUM	.000
MAXIMUM	300.000				
VALID CASES	45	MISSING CASES	1		

APPENDIX D (continue ...)

Question II.4b: Total Number of PCs

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	4	8.7	8.9	8.9
	1	4	8.7	8.9	17.8
	2	10	21.7	22.2	40.0
	3	4	8.7	8.9	48.9
	4	2	4.3	4.4	53.3
	5	5	10.9	11.1	64.4
	6	4	8.7	8.9	73.3
	8	1	2.2	2.2	75.6
	10	3	6.5	6.7	82.2
	15	1	2.2	2.2	84.4
	20	2	4.3	4.4	88.9
	22	1	2.2	2.2	91.1
	30	2	4.3	4.4	95.6
	32	1	2.2	2.2	97.8
	200	1	2.2	2.2	100.0
	999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	11.111	STD DEV	29.971	MINIMUM	.000
MAXIMUM	200.000				
VALID CASES	45	MISSING CASES	1		

- -

Question II.2c: Number of Printers

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	1	2.2	2.2	2.2
	1	3	6.5	6.7	8.9
	2	5	10.9	11.1	20.0
	3	9	19.6	20.0	40.0
	4	4	8.7	8.9	48.9
	5	4	8.7	8.9	57.8
	6	5	10.9	11.1	68.9
	8	1	2.2	2.2	71.1
	10	4	8.7	8.9	80.0
	14	1	2.2	2.2	82.2
	16	2	4.3	4.4	86.7
	20	1	2.2	2.2	88.9
	40	1	2.2	2.2	91.1
	42	1	2.2	2.2	93.3
	62	1	2.2	2.2	95.6
	100	1	2.2	2.2	97.8
	106	1	2.2	2.2	100.0
	999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	12.667	STD DEV	22.984	MINIMUM	.000
MAXIMUM	106.000				
VALID CASES	45	MISSING CASES	1		

APPENDIX D (continue ...)

Question II.4d: Number of Plotters

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	34	73.9	75.6	75.6
	1	7	15.2	15.6	91.1
	2	2	4.3	4.4	95.6
	5	1	2.2	2.2	97.8
	10	1	2.2	2.2	100.0
	999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	.578	STD DEV	1.685	MINIMUM	.000
MAXIMUM	10.000				
VALID CASES	45	MISSING CASES	1		

Question II.4e: Number of Hardisk Drives

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	5	10.9	11.4	11.4
	1	7	15.2	15.9	27.3
	2	6	13.0	13.6	40.9
	3	5	10.9	11.4	52.3
	4	5	10.9	11.4	63.6
	5	2	4.3	4.5	68.2
	6	4	8.7	9.1	77.3
	7	3	6.5	6.8	84.1
	8	1	2.2	2.3	86.4
	10	2	4.3	4.5	90.9
	12	1	2.2	2.3	93.2
	17	1	2.2	2.3	95.5
	50	1	2.2	2.3	97.7
	98	1	2.2	2.3	100.0
	99	2	4.3	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	7.136	STD DEV	16.036	MINIMUM	.000
MAXIMUM	98.000				
VALID CASES	44	MISSING CASES	2		

APPENDIX D (continue ...)

Question II.4f: Total Storage Capacity

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Magabyte	0	5	10.9	11.4	11.4
	20	3	6.5	6.8	18.2
	30	1	2.2	2.3	20.5
	54	1	2.2	2.3	22.7
	60	2	4.3	4.5	27.3
	64	1	2.2	2.3	29.5
	80	1	2.2	2.3	31.8
	100	1	2.2	2.3	34.1
	120	1	2.2	2.3	36.4
	121	1	2.2	2.3	38.6
	165	1	2.2	2.3	40.9
	200	1	2.2	2.3	43.2
	250	2	4.3	4.5	47.7
	264	1	2.2	2.3	50.0
	300	3	6.5	6.8	56.8
	328	1	2.2	2.3	59.1
	345	1	2.2	2.3	61.4
	350	1	2.2	2.3	63.6
	500	2	4.3	4.5	68.2
	600	1	2.2	2.3	70.5
	644	1	2.2	2.3	72.7
	730	1	2.2	2.3	75.0
	1200	1	2.2	2.3	77.3
	1500	1	2.2	2.3	79.5
	1800	3	6.5	6.8	86.4
	2000	1	2.2	2.3	88.6
	2200	1	2.2	2.3	90.9
	3000	1	2.2	2.3	93.2
	4000	1	2.2	2.3	95.5
	8000	1	2.2	2.3	97.7
	9900	1	2.2	2.3	100.0
	9999	2	4.3	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	999.432	STD DEV	1976.963
MINIMUM	.000		
MAXIMUM	9900.000		
VALID CASES	44	MISSING CASES	2

APPENDIX D (continue ...)

Question II.4g: % of Disk Space Occupied

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Percent	0	6	13.0	15.8	15.8
	5	2	4.3	5.3	21.1
	30	1	2.2	2.6	23.7
	40	2	4.3	5.3	28.9
	50	2	4.3	5.3	34.2
	60	2	4.3	5.3	39.5
	62	1	2.2	2.6	42.1
	65	2	4.3	5.3	47.4
	70	6	13.0	15.8	63.2
	75	1	2.2	2.6	65.8
	80	7	15.2	18.4	84.2
	85	1	2.2	2.6	86.8
	87	2	4.3	5.3	92.1
	90	3	6.5	7.9	100.0
	99	8	17.4	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	55.684	STD DEV	31.753	MINIMUM	.000
MAXIMUM	90.000				
VALID CASES	38	MISSING CASES	8		

- -

Question II.5a: Planned Additonal Number of Terminals

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	15	32.6	33.3	33.3
	1	3	6.5	6.7	40.0
	2	2	4.3	4.4	44.4
	3	4	8.7	8.9	53.3
	5	2	4.3	4.4	57.8
	7	1	2.2	2.2	60.0
	8	1	2.2	2.2	62.2
	10	8	17.4	17.8	80.0
	14	1	2.2	2.2	82.2
	20	4	8.7	8.9	91.1
	30	2	4.3	4.4	95.6
	100	1	2.2	2.2	97.8
	400	1	2.2	2.2	100.0
	999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	17.289	STD DEV	60.520	MINIMUM	.000
MAXIMUM	400.000				
VALID CASES	45	MISSING CASES	1		

APPENDIX D (continue ...)

Question II.5b: Planned Additional Number of PCs

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	15	32.6	33.3	33.3
	1	6	13.0	13.3	46.7
	2	7	15.2	15.6	62.2
	3	1	2.2	2.2	64.4
	4	1	2.2	2.2	66.7
	5	3	6.5	6.7	73.3
	6	1	2.2	2.2	75.6
	7	1	2.2	2.2	77.8
	10	5	10.9	11.1	88.9
	20	3	6.5	6.7	95.6
	30	1	2.2	2.2	97.8
	300	1	2.2	2.2	100.0
	999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	11.000	STD DEV	44.562	MINIMUM	.000
MAXIMUM	300.000				
VALID CASES	45	MISSING CASES	1		

- -

Question II.5c: Planned Additional Number of Harddisk Dirve

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	18	39.1	42.9	42.9
	1	11	23.9	26.2	69.0
	2	8	17.4	19.0	88.1
	4	2	4.3	4.8	92.9
	5	1	2.2	2.4	95.2
	8	1	2.2	2.4	97.6
	98	1	2.2	2.4	100.0
	99	4	8.7	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	3.476	STD DEV	15.029	MINIMUM	.000
MAXIMUM	98.000				
VALID CASES	42	MISSING CASES	4		

APPENDIX D (continue ...)

Question II.5d: Planned Additional Number of Disk Capacity

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Megabytes	0	18	39.1	40.0	40.0
	20	2	4.3	4.4	44.4
	30	1	2.2	2.2	46.7
	67	1	2.2	2.2	48.9
	70	1	2.2	2.2	51.1
	81	1	2.2	2.2	53.3
	100	2	4.3	4.4	57.8
	118	1	2.2	2.2	60.0
	140	1	2.2	2.2	62.2
	200	3	6.5	6.7	68.9
	400	1	2.2	2.2	71.1
	454	1	2.2	2.2	73.3
	500	3	6.5	6.7	80.0
	600	1	2.2	2.2	82.2
	700	1	2.2	2.2	84.4
	825	1	2.2	2.2	86.7
	1000	1	2.2	2.2	88.9
	1200	1	2.2	2.2	91.1
	1500	1	2.2	2.2	93.3
	2500	2	4.3	4.4	97.8
	6000	1	2.2	2.2	100.0
	9999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	456.111	STD DEV	1029.853	MINIMUM	.000
MAXIMUM	6000.000				
VALID CASES	45	MISSING CASES	1		

- -

Question II.5e: Planned Additional Number of Processing Unit

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	32	69.6	71.1	71.1
	1	10	21.7	22.2	93.3
	2	2	4.3	4.4	97.8
	30	1	2.2	2.2	100.0
	999	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	.978	STD DEV	4.459	MINIMUM	.000
MAXIMUM	30.000				
VALID CASES	45	MISSING CASES	1		

APPENDIX D (continue ...)

Question III.1: Total Number of System Support Staff

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	2	4.3	4.3	4.3
	2	8	17.4	17.4	21.7
	3	3	6.5	6.5	28.3
	4	3	6.5	6.5	34.8
	5	2	4.3	4.3	39.1
	6	4	8.7	8.7	47.8
	7	1	2.2	2.2	50.0
	8	2	4.3	4.3	54.3
	9	1	2.2	2.2	56.5
	10	3	6.5	6.5	63.0
	14	2	4.3	4.3	67.4
	15	2	4.3	4.3	71.7
	20	1	2.2	2.2	73.9
	22	1	2.2	2.2	76.1
	25	2	4.3	4.3	80.4
	26	1	2.2	2.2	82.6
	28	1	2.2	2.2	84.8
	32	1	2.2	2.2	87.0
	35	1	2.2	2.2	89.1
	50	2	4.3	4.3	93.5
	60	1	2.2	2.2	95.7
	63	1	2.2	2.2	97.8
	80	1	2.2	2.2	100.0
	TOTAL	46	100.0	100.0	

MEAN	15.370	STD DEV	18.647	MINIMUM	.000
MAXIMUM	80.000				
VALID CASES	46	MISSING CASES	0		

APPENDIX D (continue ...)

Question III.2: % of Total Employees Using Computers

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Percent	0	1	2.2	2.2	2.2
	3	1	2.2	2.2	4.3
	5	5	10.9	10.9	15.2
	8	1	2.2	2.2	17.4
	10	7	15.2	15.2	32.6
	15	1	2.2	2.2	34.8
	20	2	4.3	4.3	39.1
	25	1	2.2	2.2	41.3
	30	3	6.5	6.5	47.8
	35	1	2.2	2.2	50.0
	40	1	2.2	2.2	52.2
	50	8	17.4	17.4	69.6
	60	2	4.3	4.3	73.9
	70	3	6.5	6.5	80.4
	80	3	6.5	6.5	87.0
	90	2	4.3	4.3	91.3
	95	1	2.2	2.2	93.5
	98	3	6.5	6.5	100.0
	TOTAL	46	100.0	100.0	

MEAN	41.087	STD DEV	31.817	MINIMUM	.000
MAXIMUM	98.000				
VALID CASES	46	MISSING CASES	0		

- -

Question III.3: % of Time When Terminal/PC in Use

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Percent	1	2	4.3	4.3	4.3
	2	9	19.6	19.6	23.9
	3	2	4.3	4.3	28.3
	4	15	32.6	32.6	60.9
	5	18	39.1	39.1	100.0
	TOTAL	46	100.0	100.0	

MEAN	3.826	STD DEV	1.270	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	46	MISSING CASES	0		

APPENDIX D (continue ...)

Question III.4: % of Time When Printers are Printing

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	1	12	26.1	26.1	26.1
	2	10	21.7	21.7	47.8
	3	13	28.3	28.3	76.1
	4	7	15.2	15.2	91.3
	5	4	8.7	8.7	100.0
	TOTAL	46	100.0	100.0	

MEAN	2.587	STD DEV	1.275	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	46	MISSING CASES	0		

- -

Question III.5: Opinion to Existing Data Security

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
No Control at all	1	2	4.3	4.3	4.3
Poor	2	3	6.5	6.5	10.9
Satisfactory	3	21	45.7	45.7	56.5
Good	4	11	23.9	23.9	80.4
Exacllent	5	9	19.6	19.6	100.0
	TOTAL	46	100.0	100.0	

MEAN	3.478	STD DEV	1.027	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	46	MISSING CASES	0		

- -

Question III.6a: % of Computer Time Used forWprd Processing

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Percent	0	2	4.3	4.4	4.4
	5	9	19.6	20.0	24.4
	10	10	21.7	22.2	46.7
	15	1	2.2	2.2	48.9
	20	11	23.9	24.4	73.3
	25	2	4.3	4.4	77.8
	30	1	2.2	2.2	80.0
	40	4	8.7	8.9	88.9
	45	1	2.2	2.2	91.1
	60	2	4.3	4.4	95.6
	70	1	2.2	2.2	97.8
	90	1	2.2	2.2	100.0
	99	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	21.000	STD DEV	19.529	MINIMUM	.000
MAXIMUM	90.000				
VALID CASES	45	MISSING CASES	1		

APPENDIX D (continue ...)

Question III.6b: % of Computer Time Used for Electronic Communication

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0%	22	47.8	48.9	48.9
	5	7	15.2	15.6	64.4
	10	11	23.9	24.4	88.9
	15	2	4.3	4.4	93.3
	20	1	2.2	2.2	95.6
	30	1	2.2	2.2	97.8
	50	1	2.2	2.2	100.0
	99	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	6.111	STD DEV	9.347	MINIMUM	.000
MAXIMUM	50.000				
VALID CASES	45	MISSING CASES	1		

- -

Question III.6c: % of Computer Time Used for Data Base Management

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	13	28.3	28.9	28.9
	5	10	21.7	22.2	51.1
	10	6	13.0	13.3	64.4
	15	1	2.2	2.2	66.7
	20	8	17.4	17.8	84.4
	25	1	2.2	2.2	86.7
	30	2	4.3	4.4	91.1
	40	1	2.2	2.2	93.3
	45	1	2.2	2.2	95.6
	50	1	2.2	2.2	97.8
	80	1	2.2	2.2	100.0
	99	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	13.000	STD DEV	16.251	MINIMUM	.000
MAXIMUM	80.000				
VALID CASES	45	MISSING CASES	1		

APPENDIX D (continue ...)

Question III.6d: % of Computer Time Used for Processing/Calculation

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0%	4	8.7	8.9	8.9
	5	1	2.2	2.2	11.1
	10	6	13.0	13.3	24.4
	15	1	2.2	2.2	26.7
	20	7	15.2	15.6	42.2
	30	4	8.7	8.9	51.1
	40	2	4.3	4.4	55.6
	45	1	2.2	2.2	57.8
	50	5	10.9	11.1	68.9
	55	1	2.2	2.2	71.1
	60	4	8.7	8.9	80.0
	65	1	2.2	2.2	82.2
	70	3	6.5	6.7	88.9
	80	4	8.7	8.9	97.8
	95	1	2.2	2.2	100.0
	99	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN 37.778 STD DEV 26.853 MINIMUM .000
MAXIMUM 95.000
VALID CASES 45 MISSING CASES 1

- -

Question III.6e: % of Computer Time Used for Programming/Maintenance

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0%	3	6.5	6.7	6.7
	5	4	8.7	8.9	15.6
	10	14	30.4	31.1	46.7
	15	5	10.9	11.1	57.8
	20	5	10.9	11.1	68.9
	25	2	4.3	4.4	73.3
	30	5	10.9	11.1	84.4
	40	3	6.5	6.7	91.1
	42	1	2.2	2.2	93.3
	50	2	4.3	4.4	97.8
	80	1	2.2	2.2	100.0
	99	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN 19.489 STD DEV 15.988 MINIMUM .000
MAXIMUM 80.000
VALID CASES 45 MISSING CASES 1

APPENDIX D (continue ...)

Question III.6f: % of Computer Time Used for Other Activvties

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0%	36	78.3	80.0	80.0
	3	1	2.2	2.2	82.2
	5	2	4.3	4.4	86.7
	10	2	4.3	4.4	91.1
	15	1	2.2	2.2	93.3
	20	2	4.3	4.4	97.8
	30	1	2.2	2.2	100.0
	99	1	2.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	2.622	STD DEV	6.527	MINIMUM	.000
MAXIMUM	30.000				
VALID CASES	45	MISSING CASES	1		

- -

Question III.7a: Adequacy of CPU Processing Power

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Inadequate	1	2	4.3	4.3	4.3
	2	10	21.7	21.7	26.1
	3	15	32.6	32.6	58.7
	4	7	15.2	15.2	73.9
Adequate	5	12	26.1	26.1	100.0
	TOTAL	46	100.0	100.0	

MEAN	3.370	STD DEV	1.218	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	46	MISSING CASES	0		

- -

Question III.7b: Adequacy of Printing Facilities

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Inadequate	1	2	4.3	4.3	4.3
	2	4	8.7	8.7	13.0
	3	14	30.4	30.4	43.5
	4	10	21.7	21.7	65.2
Adequate	5	16	34.8	34.8	100.0
	TOTAL	46	100.0	100.0	

MEAN	3.739	STD DEV	1.163	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	46	MISSING CASES	0		

APPENDIX D (continue ...)

Question III.7c: Adequacy of Storage Capacity

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Inadequate	1	4	8.7	8.7	8.7
	2	10	21.7	21.7	30.4
	3	15	32.6	32.6	63.0
	4	4	8.7	8.7	71.7
Adequate	5	13	28.3	28.3	100.0
	TOTAL	46	100.0	100.0	

MEAN	3.261	STD DEV	1.324	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	46	MISSING CASES	0		

- -

Question III.7d: Adequacy of Communication Capability

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Inadequate	1	1	2.2	2.2	2.2
	2	8	17.4	17.4	19.6
	3	11	23.9	23.9	43.5
	4	12	26.1	26.1	69.6
Adquate	5	11	23.9	23.9	93.5
	9	3	6.5	6.5	100.0
	TOTAL	46	100.0	100.0	

MEAN	3.913	STD DEV	1.749	MINIMUM	1.000
MAXIMUM	9.000				
VALID CASES	46	MISSING CASES	0		

- -

Question III.8a: Current User of Minicomputers

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
No	0	20	43.5	43.5	43.5
Yes	1	26	56.5	56.5	100.0
	TOTAL	46	100.0	100.0	

MEAN	.565	STD DEV	.501	MINIMUM	.000
MAXIMUM	1.000				
VALID CASES	46	MISSING CASES	0		

APPENDIX D (continue ...)

Question III.8b: Current User of Local Area Network

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
No	0	41	89.1	89.1	89.1
Yes	1	5	10.9	10.9	100.0
	TOTAL	46	100.0	100.0	

MEAN	.109	STD DEV	.315	MINIMUM	.000
MAXIMUM	1.000				
VALID CASES	46	MISSING CASES	0		

- -

Question III.8c: Neither Mini User Nor LAN User

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
No	0	28	60.9	60.9	60.9
Yes	1	18	39.1	39.1	100.0
	TOTAL	46	100.0	100.0	

MEAN	.391	STD DEV	.493	MINIMUM	.000
MAXIMUM	1.000				
VALID CASES	46	MISSING CASES	0		

- -

Question IV.1: Supplier of Local Area Network

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
IBM PC Network	1	3	6.5	60.0	60.0
OmniNet	2	1	2.2	20.0	80.0
EtherNet	3	1	2.2	20.0	100.0
	99	41	89.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	1.600	STD DEV	7.554	MINIMUM	1.000
MAXIMUM	20.000				
VALID CASES	6	MISSING CASES	40		

APPENDIX D (continue ...)

Question IV.2: Number of Workstations Linked to the LAN

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	2	1	2.2	25.0	25.0
	6	1	2.2	25.0	50.0
	20	1	2.2	25.0	75.0
	40	1	2.2	25.0	100.0
	9999	42	91.3	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	17.000	STD DEV	17.166	MINIMUM	2.000
MAXIMUM	40.000				
VALID CASES	4	MISSING CASES	42		

- -

Question IV.3: Installation Cost of LAN

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
HK Dollars	22100	1	2.2	33.3	33.3
	40000	1	2.2	33.3	66.7
	50000	1	2.2	33.3	100.0
	9999999	43	93.5	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	37366.667	STD DEV	14135.181	MINIMUM	22100.000
MAXIMUM	50000.000				
VALID CASES	3	MISSING CASES	43		

- -

Question IV.4: User's satisfaction

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Average	3	2	4.3	40.0	40.0
Good	4	2	4.3	40.0	80.0
Exacllent	5	1	2.2	20.0	100.0
	9	41	89.1	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	3.800	STD DEV	.837	MINIMUM	3.000
MAXIMUM	5.000				
VALID CASES	5	MISSING CASES	41		

APPENDIX D (continue ...)

Question V.1: Major Suppliers Minicomputer

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
IBM	1	6	13.0	25.0	25.0
NCR	3	1	2.2	4.2	29.2
DEC	4	4	8.7	16.7	45.8
Hitachi	5	1	2.2	4.2	50.0
Cromemco	7	1	2.2	4.2	54.2
Datapoint	8	1	2.2	4.2	58.3
Alpha Micro Prime	13	2	4.3	8.3	66.7
Perkin Elmer	14	3	6.5	12.5	79.2
NEC	15	1	2.2	4.2	83.3
Hewlett Packard	16	1	2.2	4.2	87.5
Develcon	17	1	2.2	4.2	91.7
Bondwell	18	1	2.2	4.2	95.8
Wang	19	1	2.2	4.2	100.0
	99	22	47.8	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	8.250	STD DEV	6.476	MINIMUM	1.000
MAXIMUM	19.000				
VALID CASES	24	MISSING CASES	22		

- -

Question V.2: Number of Terminals Linked to the Minicomputer

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
	0	1	2.2	4.3	4.3
	1	1	2.2	4.3	8.7
	4	2	4.3	8.7	17.4
	5	2	4.3	8.7	26.1
	6	1	2.2	4.3	30.4
	8	2	4.3	8.7	39.1
	10	3	6.5	13.0	52.2
	14	1	2.2	4.3	56.5
	16	1	2.2	4.3	60.9
	17	1	2.2	4.3	65.2
	20	1	2.2	4.3	69.6
	22	2	4.3	8.7	78.3
	32	1	2.2	4.3	82.6
	49	1	2.2	4.3	87.0
	50	1	2.2	4.3	91.3
	229	1	2.2	4.3	95.7
	300	1	2.2	4.3	100.0
	9999	23	50.0	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	36.609	STD DEV	73.916	MINIMUM	.000
MAXIMUM	300.000				
VALID CASES	23	MISSING CASES	23		

APPENDIX D (continue ...)

Question V.3: Installation Cost per Terminal

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
HK Dollars	0	1	2.2	5.3	5.3
	8000	2	4.3	10.5	15.8
	10000	3	6.5	15.8	31.6
	11000	1	2.2	5.3	36.8
	13000	1	2.2	5.3	42.1
	15000	1	2.2	5.3	47.4
	16000	1	2.2	5.3	52.6
	17000	1	2.2	5.3	57.9
	20000	3	6.5	15.8	73.7
	25000	3	6.5	15.8	89.5
	50000	2	4.3	10.5	100.0
	9999999	27	58.7	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	18578.947	STD DEV	12919.906
MINIMUM	.000	MAXIMUM	50000.000
VALID CASES	19	MISSING CASES	27

- -

Question V.4: User's satisfaction

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Not satisfactory	2	1	2.2	4.5	4.5
Average	3	4	8.7	18.2	22.7
Good	4	14	30.4	63.6	86.4
Excellent	5	3	6.5	13.6	100.0
	9	24	52.2	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	3.864	STD DEV	.710
MINIMUM	2.000	MAXIMUM	5.000
VALID CASES	22	MISSING CASES	24

APPENDIX D (continue ...)

Question VI.1a: Probability of Install LAN in the next 2 Year

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Impossible	1	8	17.4	34.8	34.8
	2	4	8.7	17.4	52.2
	3	5	10.9	21.7	73.9
	4	5	10.9	21.7	95.7
Very Likely	5	1	2.2	4.3	100.0
	9	23	50.0	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	2.435	STD DEV	1.308	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	23	MISSING CASES	23		

- -

Question VI.1b: Probability of Install Minicomputer in the next 2 Year

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
Impossible	1	12	26.1	52.2	52.2
	2	6	13.0	26.1	78.3
	3	2	4.3	8.7	87.0
Very Likely	5	3	6.5	13.0	100.0
	9	23	50.0	MISSING	
	TOTAL	46	100.0	100.0	

MEAN	1.957	STD DEV	1.364	MINIMUM	1.000
MAXIMUM	5.000				
VALID CASES	23	MISSING CASES	23		

- -

Number of High Potential User of Local Area Networks

VALUE LABEL	VALUE	FREQUENCY	PERCENT	VALID PERCENT	CUM PERCENT
High Potential Users	1.00	15	32.6	32.6	32.6
Low Potential Users	2.00	31	67.4	67.4	100.0
	TOTAL	46	100.0	100.0	

MEAN	1.674	STD DEV	.474	MINIMUM	1.000
MAXIMUM	2.000				
VALID CASES	46	MISSING CASES	0		

Convergent Microsystems (H K) Ltd.

3Com EtherSeries

Price List

Effective November 1, 1985

NETWORK SERVER & EXPANSION UNITS

EN 3C 1001	3C1001 3Server Network Server (70MB Version)	US$8,995.00
EN 3C 1021	3C1021 3Server Expansion Disk (70MB Version)	US$4,995.00
EN 3C 1030	3C1030 3Server 60MB Tape Backup	US$3,295.00
EN 3C 1010	3C1010 3Server 384KB Memory Expansion Board	US$ 995.00
EN 3C 1050	3C1050 3Server Port Expansion Board	US$ 695.00
EN 3C 1070	3C1070 SCSI Terminator	US$ 99.00

NETWORK INTERFACES

EN 3C 501X	3C501 EtherLink (Version 2.4 for DOS 2.0, 2.1 or 3.0)	US$ 650.00
EN 3C 505X	3C505 EtherLink Plus	US$1,095.00

3PLUS SOFTWARE

EN 3C 2000	3C2000 3+Share for PC Server	US$ 550.00
EN 3C 2001	3C2001 3+Share for 3Server	US$ 550.00
EN 3C 2010	3C2010 3+Share User	US$ 75.00
EN 3C 900X	3C900 3+Path for PC Server	US$ 500.00
EN 3C 901X	3C901 3+Path for 3Server	US$ 500.00
EN 3C 2300	3C2300 3+Route for PC Server	US$1,250.00
EN 3C 2301	3C2301 3+Route for 3Server	US$1,250.00
EN 3C 2310	3C2310 3+Remote PC User	US$ 395.00
EN 3C 2200	3C2200 3+Manus	US$ 150.00
EN 3C 2100	3C2100 3+Mail for PC Server	US$ 250.00
EN 3C 2101	3C2101 3+Mail for 3Server	US$ 250.00
EN 3C S505	3CS-2505 3+Packet Library Object Code	US$1,495.00
EN 3C S506	3CS-2506 3+Packet Library Licsase	US$2,495.00

UNIT 1111, TOWER A, HUNG HOM COMMERCIAL CENTRE,
39, MATAUWEI ROAD, KOWLOON,
HONG KONG.

TELEPHONE: (3) 636697
TELEX: 51847 CVGMS HX
CABLE ADDRESS: 5894

Convergent Microsystems (H K) Ltd.

ETHERSERIES SOFTWARE

EN 3C 641C	3C641C EtherShare for PC Server	US$ 450.00
EN 3C 1040	3C1040 EtherShare for 3Server	US$ 450.00
EN 3C 651B	3C651B EtherPrint for PC Server	US$ 195.00
EN 3C 1041	3C1041 EtherPrint for 3Server	US$ 195.00
EN 3C 661B	3C661B EtherMail for PC Server	US$ 395.00
EN 3C 1042	3C1042 EtherMail for 3Server	US$ 395.00
EN 3C 595X	3C595 EtherSeries User Software	US$ 60.00
EN 3C 502X	3C502 EtherStart ROM	US$ 125.00
EN 3C S675	3CS-675 EtherSeries Packet Library	US$ 800.00

GATEWAY

EN 3C 681X	3C681 Ether3270	US$1,595.00
EN 3C 1500	3C1500 EtherMac	US$ 75.00

TRANSCEIVERS

(Piercing Tap, Standard Cable non-intrusive connection)

EN 3C 101X	3C101 Ethernet/IEEE 802.3 Piercing Tap Transceiver	US$ 295.00
EN 3C 135X	3C135 Piercing Tap Cable Installation Kit	US$ 75.00
EN 3C 136X	3C136 Replacement Probes, Qty 5	US$ 75.00
EN 3C 137X	3C137 Replacement Shield Connectors, Qty 100	US$ 75.00
EN 3C 138X	3C138 Replacement Piercing Tap Block	US$ 50.00

(N-Series, Standard Cable connection)

EN 3C 102X	3C102 Ethernet/IEEE 802.3 Connectorized Transceiver	US$ 295.00
EN 3C 139X	3C139 Replacement Connector Module	US$ 50.00

(BNC, Thin Cable connection)

EN 3C 103A	3C103A Ethernet/IEEE 802.3 BNC Connectorized Transceiver	US$ 295.00
EN 3C 193A	3C193A Replacement BNC Connector Module	US$ 50.00

UNIT 1111, TOWER A, HUNG HOM COMMERCIAL CENTRE,
39, MATAUWEI ROAD, KOWLOON,
HONG KONG.

TELEPHONE: (3) 636697
TELEX: 51847 CVGMS HX
CABLE ADDRESS: 5294

Convergent Microsystems (H K) Ltd.

CABLE & CABLE ADAPTERS

EN 3C T007	Thin Ethernet cable with connectors - 7 meters	US$	21.00
EN 3C T015	Thin Ethernet cable with connectors - 15 meters	US$	32.00
EN 3C T030	Thin Ethernet cable with connectors - 30 meters	US$	53.00
EN 3C TXXX	Thin Ethernet cable with connectors - xxx meter Minimum length 60 meter	US$ plus US$	1.10/m 21.00
EN 3C 535X	3C535 Thin Ethernet Terminator Kit (Two 50-ohm BNC terminators)	US$	50.00
EN 3C 536X	3C536 Thin Ethernet Barrel Connector (BNC)	US$	10.00
EN 3C 537X	3C537 Thin Ethernet Loopback Plug	US$	50.00
EN 3C 539X	3C539 Thin Ethernet T Connector (BNC)	US$	10.00
EN 3C 539A	3C539A Thin Ethernet Extended T Connector (BNC)	US$	30.00
EN 3C 110X	Standard Ethernet Transceiver Cable - 5 meter	US$	100.00
EN 3C E015	Standard Ethernet Coaxial Cable with connectors - 15 meter	US$	150.00
EN 3C 130X	3C130 Standard Ethernet Terminator (one 50-ohm N-series terminator)	US$	20.00
EN 3C 160X	3C160 Standard Ethernet N-series Barrel Connector, Female-female connects two Ethernet cable segments	US$	10.00
EN 3C 161X	3C161 Standard Ethernet N-series Barrel Connector, Male-male connects two transceivers	US$	25.00
EN 3C 538X	3C538 Standard Ethernet Loopback Plugs	US$	50.00
EN 3C 540X	3C540 Adapters Between Thin and Standard Ethernet, Cable to Cable	US$	30.00
EN 3C 541X	3C541 Adapters Between Thin and Standard Ethernet, Thin Cable to Transceiver	US$	15.00
EN 3C BXXX	Bulk Thin Ethernet Cable without connector - XXX Meter Minimum length 200 meter	US$	1.10/m
EN 3C SXXX	Bulk Standard Ethernet Coaxial Cable without connector - XXX Meter, minimum length 100 meter	US$	7.00/m
EN 3C 542X	3C542 Insulated Connector for Thin Cable	US$	3.00
EN 3C 150X	3C150 Insulated Connector for Standard Cable	US$	10.00

UNIT 1111, TOWER A, HUNG HOM COMMERCIAL CENTRE,
39, MATAUWEI ROAD, KOWLOON,
HONG KONG.

TELEPHONE: (3) 636397
TELEX: 51847 CVGMS HX
CABLE ADDRESS: 5294

Convergent Microsystems (H K) Ltd.

DOCUMENTATION

EN 3C 2500	3C2500 3+Share Administrator's Guide	US$ 70.00
EN 3C 2503	3C2503 3+Menus User Guide	US$ 40.00
EN 3C 2508	3C2508 3+Joy of Networking	US$ 60.00
EN 3C 2501	3C2501 3+Network Guide	US$ 40.00
EN 3C 2504	3C2504 3+Theory of Operations	US$ 30.00
EN 3C 591B	3C591B EtherSeries Administrator's Guide for PC Server	US$ 50.00
EN 3C 1091	3C1091 EtherSeries Administrator's Guide for 3Server	US$ 50.00
EN 3C 400X	3C400 EtherSeries Joy of Networking	US$ 30.00
EN 3C 500X	3C500 Ether3270 User Guide	US$ 30.00
EN 3C 5481	3C5481 EtherSeries Internals Manual	US$ 50.00
EN 3C 1099	3C1099 3Server Hardware Manuals	US$100.00
EN 3C 1071	3C1071 3Server Hardware Maintenance and Service Manual	US$350.00
EN 3C 1075	3C1075 3Server Technical Reference Manual	US$ 75.00
EN 3C 575X	3C575 EtherLink Plus Software Developer's Guide	US$100.00

SUNOL INTELLIGENT HARD DISK

SU SS D040	Sunol 41.9 Mbytes (Formatted) Main Unit	US$4,595.00
SU SS D065	Sunol 65.5 Mbytes (Formatted) Main Unit	US$5,295.00
SU SS D110	Sunol 110 Mbytes (Formatted) Main Unit	US$6,995.00
SU SN IFIB	SuNet Interface for IBM-PC/XT	US$ 140.00
SU SW IBM2	SuNet Driver Software for IBM-PC/XT	US$ 50.00

UNIT 1111, TOWER A, HUNG HOM COMMERCIAL CENTRE,
39, MATAUWEI ROAD, KOWLOON,
HONG KONG.

TELEPHONE: (3) 636397
TELEX: 51947 CVGMS HX
CABLE ADDRESS: 5294

Convergent Microsystems (H K) Ltd.

ETHERNET BASIC CONFIGURATION

BASIC HARDWARE SYSTEM SETUP :

2 Sets PC-II with 192 KB RAM, AND

1 Set PC/XT with 256 KB RAM
or 1 Set PC-II with 256 KB RAM & external hard disk(e.g. Sonol System)

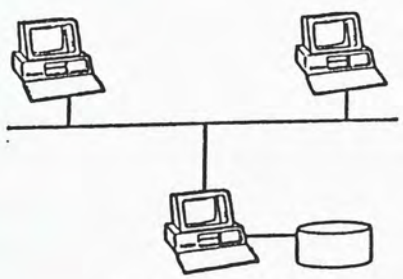
ETHERNET SETUP :

QTY	P/N	DESCRIPTION	UNIT PRICE
3	EN 3C 501X	3C501 EtherLink	US$650.00
1	EN 3C 595X	3C595 EtherSeries User Software	US$ 60.00
1	EN 3C 641C	3C641C EtherShare/PC Server Software	US$450.00
1	EN 3C 651B	3C651B EtherPrint/PC Server Software	US$195.00
1	EN 3C 661B	3C661B EtherMail/PC Server Software	US$395.00
2	EN 3C T007	Thin EtherNet Cable - 7 meter	US$ 21.00
	EN 3C T015	Thin EtherNet Cable - 15 meter	US$ 32.00
	EN 3C T030	Thin EtherNet Cable - 30 meter	US$ 53.00
1	EN 3C 535X	3C535 Thin EtherNet Terminator Kit	US$ 50.00

$1756.00

* * EACH ADDITION PC STATION REQUIRE * *

1	EtherLink/IBM-PC	650
1	EtherSeries User Software	60
1	Thin EtherNet Cable	32
		742



IBM PCs Sharing An Ethernet Segment

UNIT 1111, TOWER A, HUNG HOM COMMERCIAL CENTRE,
39, MATAUWEI ROAD, KOWLOON,
HONG KONG.

TELEPHONE: (3) 636397
TELEX: 51847 CVGMS HX
CABLE ADDRESS: 5294

COMPAC MICROELECTRONICS (HK) LTD.

CORVUS

RETAIL PRICE LIST

NOVEMBER 20, 1985

NETWORK/MASS STORAGE SYSTEMS

OMNIDRIVE STARTER KITS

5-XX-XX-2	5.5MB SYSTEM, 220V	$ 1870
11-XX-XX-2	11.1MB SYSTEM, 220V	2495
21-XX-XX-2	20.9MB SYSTEM, 220V	3295
45-XX-XX-2	45.1MB SYSTEM, 220V	5495
126-XX-XX-2*	125.7MB SYSTEM, 220V	9495

*(IBM & APPLE IIe ONLY)

Note: Starter Kit includes OmniDrive, one Omninet network card and network software. Order for a single computer or as a network starter kit. Network card is computer specific; software is operating system specific. Replace XX-XX with four letter software product codes shown below.

SOFTWARE PRODUCT CODES

AP-CO	APPLE IIe CP/M
AP-D3	APPLE IIe DOS 3.3
AP-P1	APPLE IIe PASCAL
AP-PD	APPLE IIe ProDOS
A3-S1	APPLE III SOS
MP-D2	COMPANION MS-DOS 2.11
DB	DEC CP/M & MS-DOS
IB-D3	IBM DOS 2.0, 2.1, 3.0
IB-P4	NCIP-SYSTEM FOR IBM PC

APPLE MACINTOSH - MULTI USER STARTER KIT

5-AM-F1	5.5MB OMNIDRIVE FOR APPLE MACINTOSH	$ 1870
11-AM-F1	11.1MB OMNIDRIVE FOR APPLE MACINTOSH	2495
21-AM-F1	20.9MB OMNIDRIVE FOR APPLE MACINTOSH	3295
45-AM-F1	45.1MB OMNIDRIVE FOR APPLE MACINTOSH	5495

Note: Starter Kit for single Macintosh. Includes OmniDrive, one interface and cable, and software.

OMNIDRIVE SYSTEM

5-2	5.5MB OMNINET DISK DRIVE SYSTEM	$ 1245
11-2	11.1MB OMNINET DISK DRIVE SYSTEM	1870
21-2	20.9MB OMNINET DISK DRIVE SYSTEM	2795
45-2	45.1MB OMNINET DISK DRIVE SYSTEM	4995
126-2	125.7MB OMNINET DISK DRIVE SYSTEM	8995

Note: The OmniDrive system consists of an OmniDrive(with built-in disk server), 3 tap boxes, 15-foot tap cable, convenience connector and installation guide.

OMNISHARE

PCS-IB	OMNISHARE SOFTWARE AND TRANSPORTER	$ 795

Note: OmniShare package consists of an IBM Transporter card, 3 tap boxes, tap cable, software and manuals.
OmniShare allows an IBM XT with attached hard disk to emulate a Corvus OmniDrive, thereby allowing other IBM PC stations to share data on the hard disk.

MIRROR CARD

MXT-1	MIRROR CARD FOR IBM PC/XT/AT	$ 595

Note: The Mirror Card allows back-up of the IBM fixed disk on video tape.

OMNINET TRANSPORTER

OMNI/IB	OMNINET TRANSPORTER CARD FOR IBM	$ 495
OMNI/JR	OMNINET TRANSPORTER CARD FOR IBM PC Jr	495
OMNI/AP	OMNINET TRANSPORTER CARD FOR APPLE II/IIe	495
OMNI/A3	OMNINET TRANSPORTER CARD FOR APPLE III	495
OMNI/DB	OMNINET TRANSPORTER CARD FOR DEC RAINBOW 100	495

Note: 1 transporter card, 1 cable, 1 tap box, 1 manual

OMNINET PRINTER SERVER

PS-IB-2	PRINTER SERVER FOR IBM	$ 1238
PS-AP-2	PRINTER SERVER FOR APPLE II/IIe	1238
PS-A3-2	PRINTER SERVER FOR APPLE III	1238
PS-DB-2	PRINTER SERVER FOR DEC RAINBOW 100	1238

Note: The Printer Server comes with tap box, tap cable, Printer Server software and manuals(as specified with models).

THE BANK - ARCHIVAL STORAGE "BACKUP" SYSTEM

BK-IB-2	BANK SYSTEM FOR IBM	$ 2744
BK-AP-2	BANK SYSTEM FOR APPLE	2744
BKS-IB	BANK SOFTWARE FOR IBM	195
BKS-AP	BANK SOFTWARE FOR APPLE	195
BT100	100MB TAPE CARTRIDGE FOR THE BANK	88
BT200	200MB TAPE CARTRIDGE FOR THE BANK	125

MIRROR SERVER

MS-IB-2	MIRROR SERVER FOR IBM	$ 995
MS-AP-2	MIRROR SERVER FOR APPLE II/IIe	995
MS-IB-2	MIRROR SERVER FOR APPLE III	995
MS-IB-2	MIRROR SERVER FOR DEC RAINBOW 100	995

Note: The Mirror Server allows back-up of a Corvus OmniDrive on video tape in either VHS or Beta format.
The Mirror Server package consists of a Mirror unit, software, tap box, 15-foot cable, and manuals.

CONSTELLATION II SINGLE/MULTI-COMPUTER SOFTWARE

C2M-IB-D2	DOS 2.N UTILITIES FOR IBM PC/XT/AT	$ 150
C2M-IB-D3	DOS 3.N UTILITIES FOR IBM PC/XT/AT	150
C2M-AP-D3	DOS 3.3 UTILITIES FOR APPLE II/IIe	150
C2M-AP-P1	PASCAL 1.1 UTILITIES FOR APPLE II/IIe	150
C2M-AP-CO	CP/M 80 UTILITIES FOR APPLE II/IIe	150
C2M-A3-S1	SOS 1.3 UTILITIES FOR APPLE III	150
C2M-DB-D2	DOS 2.1 UTILITIES FOR DEC RAINBOW 100	150
C2M-DB-D6	CP/M 86 UTILITIES FOR DEC RAINBOW 100	150
CS-AP	APPLE II/IIe CONSTELLATION SOFTWARE	125
AP-CPM	APPLE II/IIe MICROSOFT CP/M VER 2.2	125

CORVUS APPLICATION SOFTWARE

SC-LDS-IB	LAN: DATASTORE - IBM ONLY	$ 945
SC-LDC-IB	LAN: DATACORE - IBM ONLY	945
SC-LMM-IB/AP	LAN: MAIL MONITOR - IBM & APPLE II/IIe	745
SC-LTK-AP	LAN: TIMEKEEPER - APPLE II/IIe	695
SC-CM-AP	LAN: CLASSROOM MONITOR - APPLE II/IIe	495

MANUAL		
MAN-IB-D2	DOS 2.N UTILITIES MANUAL FOR IBM	$ 65
MAN-IB-D3	DOS 3.N UTILITIES MANUAL FOR IBM	65
MAN-AP-D3	DOS 3.3 UTILITIES MANUAL FOR APPLE II/IIe	65
MAN-AP-CO	CP/M 80 UTILITIES MANUAL FOR APPLE II/IIe	65
MAN-AP-P1	PASCAL 1.1 UTILITIES MANUAL FOR APPLE II/IIe	65
MAN-AP-S1	SOS 1.3 UTILITIES MANUAL FOR APPLE III	65
MAN-DB-D2	DOS 2.1 UTILITIES MANUAL FOR DEC RAINBOW 100	65
MAN-DB-C6	CP/M UTILITIES MANUAL FOR DEC RAINBOW 100	65
MAN-OMREF	OMNINET PROGRAMMER'S REFERENCE MANUALS	35

OMNINET NETWORK ACCESSORIES		
OCBL	OMNINET CABLE, 1000FT	$ 250
TBP	PACKAGE OF 4 TAP BOXES	39
AJB-2	ACTIVE JUNCTION BOX	195

COMPANION COMPUTER		
NP-256-2	256K, CORVUS COMPANION	$ 1695
NPC-256-2	256K, CORVUS COLOR COMPANION	1995
NP-512-2	512K, CORVUS COMPANION	1995
NPC-512-2	512K. CORVUS COLOR COMPANION	2295

Note: Includes CPU and keyboard; order software separately.
Monitor not available through Corvus.

DODWELL PERSONAL COMPUTER STORE
Shop L/G 47, Silvercord,
ASIA COMPUTER PLAZA
30 Canton Road,
Kowloon
Tel : 3-698437

Head Office : 3/F. Elizabeth H
Causeway Bay,
Hong Kong
5-8316333

November 19, 198

IBM PC PRICE LIST

HARDWARE

Category	Item No.	Description	Price (U
	5150168	PC System Unit with XT Mother Board (256KB, One 360KB Drive) (Note 1)	2,418.(
	5150178	PC System Unit with XT Mother Board (256KB, Two 360KB Drive) (Note 2)	2,733.(
	5151002	Monochrome Display	336.(
	5152004	Graphics Printer	528.(
	5153002	Color Display	273.(
	6453732	Wheelprinter/Model 5216	2,155.(
	1341356	Quietwriter Printer	1,676.(
		Auto Sheet Feed	421.(
		Form Feed	90.(
	6934693	Proprinter	652.(
	1686266	Color Jetprinter	872.(
	5154002	Enhanced Color Display	985.(
	5175002	Professional Graphics Display	1,484.(
	5150486	256K PCXT System Unit (Note 3)	4,146.(
	1561401	Expansion Unit Model for PC	2,978.(
	5161402	Expansion Unit Model for PCXT	2,418.(
Features	1501002	Math Co-Processor 8087	262.(
	1501003	64K Memory Kit	114.(
	1501005	Bios Update Kit	34.(
	1501013	64/256K Memory Expansion Option	302.(
	1501100	Keyboard (PC, PCXT)	307.(
	1501206	Cluster Adaptor	423.(
	1501207	Cluster Cable Kit	121.(
	1501300	Game Control Adaptor	53.(
	1501400	Prototype Card	42.(
	1502067	Communication Adaptor Cable	77.(
	1502074	Asynchronous Comm. Adaptor	115.(
	1502075	Binary Synch Comm. Adaptor	274.(
	1502090	SDLC Adaptor	274.(
	1503780	Diskette Drive Adaptor	144.(
	1503800	Diskette Drive/360KB	486.(
	1504900	Monochrome Display & Printer Adaptor	285.(
	6451501	Professional Graphics Controller	3,387.(
	1504910	Color/Graphics Monitor Adaptor	271.(
	1501200	Enhanced Graphic Adaptor	595.(
	1501201	Graphics Memory Expansion Card	227.(
	1501203	Graphics Memory Module Kit	294.(
	1505206	Printer Adaptor	87.(
	1525612	Printer Cable	53.(
	1525614	Printer Stand	55.(
	1602500	Fixed Disk Drive (10MB)	1,263.(
	1602501	Fixed Disk Adaptor Card	528.(
	6092656	5250 Convenience Kit (Note 4)	999.(
	6113540	5520 Convenience Kit V1.0 (Note 5)	999.(
	6109564	5520 Convenience Kit V2.0 (Note 6)	1,137.(

SAMPLE CONFIGURATION FOR IBM PERSONAL COMPUTER

A. Entry Level System

Description	Price (US$)
PC System Unit with XT Mother Board (256KB, One 360KB Drive)	2,418.00
Monochrome Display	336.00
Monochrome Display/Printer Adaptor	285.00
	3,039.00

B. Enhanced System

Description	Price (US$)
PC System Unit with XT Mother Board (256KB, Two 360KB Drive)	2,733.00
Monochrome Display	336.00
Monochrome Display/Printer Adaptor	285.00
Epson FX-105 Printer	700.00
Printer Cable	53.00
	4,107.00

C. PCXT System

Description	Price (US$)
PCXT System Unit (256KB, 360KB Floppy Disk & 10MB Hard Disk	4,146.00
Monochrome Display	336.00
Monochrome Display/Printer Adaptor	285.00
Epson FX-105 Printer	700.00
Printer Cable	53.00
	5,520.00

NOTE 1

The price of one PCXT Mother Board system unit includes the following options :

* 1 x 256KB Processor
* 1 x Keyboard
* 1 x 360KB Diskette Drive and Adaptor
* 1 x Power Cord
* 1 x Operations Guide Manual
* 1 x Basic Reference Manual

NOTE 2

The price of one PCXT Mother Board system unit includes the following options :

* 1 x 256KB Processor
* 1 x Keyboard
* 2 x 360KB Diskette Drive and Adaptor
* 1 x Power Cord
* 1 x Operations Guide Manual
* 1 x Basic Reference Manual

NOTE 3

The price of one PCXT system unit includes the following options:

* 1 x 256KB Processor
* 1 x Keyboard
* 1 x 10MB Fixed Disk Drive and Adaptor
* 1 x 360KB Diskette Drive and Adaptor
* 1 x Power Cord
* 1 x Operations Guide Manual
* 1 x Basic Reference Manual

NOTE 4

The 5250 Convenience Kit includes the following :

* 1 x Emulation Adaptor (6113538)
* 1 x 5250 Emulation Program (6092651)
* 1 x Twinaxial Cable Assembly (6100218)
* 1 x T-Connector (6851167)

NOTE 5 & NOTE 6

The 5520 Convenience includes the following :

* 1 x Emulation Adaptor (6113538)
* 1 x 5520 Emulation Program Ver 1.0 (6113551)
  (Ver 2.0 6109558 for Note 6)
* 1 x Twinaxial Cable Assembly (6100218)
* 1 x T-Connector (6851167)

DODWELL PERSONAL COMPUTER STORE
Shop L/G 47, Silvercord,
ASIA COMPUTER PLAZA
30 Canton Road,
Kowloon
Tel : 3-688437

Head Office : 13/F., Fleet House,
38 Gloucester Road,
Hong Kong
5-8616333

November 19, 1985

NON IBM LOGO PRICE LIST

	Price (US$)
DOT MATRIX PRINTER	
Epson SQ-2000 Printer	2,100.00
Epson SQ-2000 Single Sheet Feeder	440.00
Epson SQ-2000 Double Sheet Feeder	750.00
Epson SQ-2000 Tractor	85.00
Epson LQ-1500K Printer (200 cps)	1,280.00
Epson LQ-1500K Single Sheet Feeder	440.00
Epson LQ-1500K Double Sheet Feeder	750.00
Epson LQ-1500K Tractor	65.00
Epson FX-105 Printer (160 cps)	700.00
Epson FX-105 Sheet Feeder	250.00
Epson FX-80 Printer (160 cps)	510.00
Epson FX-80 Sheet Feeder	230.00
Toshiba P1351 Printer (200 cps)	1,075.00
Toshiba P1351 Auto Sheet Feeder	650.00
Toshiba P1351 Tractor	165.00
Toshiba P1351 Bi-Direction Tractor	140.00
Toshiba P1340 Printer	395.00
Toshiba P1340 Interface Conversion Cable	100.00
Brother M2024 Printer	1,715.00
NEC P3 Pinwriter	720.00
NEC P3 Cut Sheet Feeder	300.00
NEC P3 Form Tractor	120.00
NEC P2 Pinwriter	600.00
NEC P2 Cut Sheet Feeder	230.00
NEC P2 Form Tractor	100.00
HIGH SPEED PRINTER	
HP Laser Jet Printer (8 pages/min., 480 cps)	4,169.00
New Bury Data 8850 (300 lines/min.)	4,000.00

	Price (US$)
DAISY WHEEL / SPINWRITER / PLOTTER	
Wheelprinter/Model 5216	2,155.00
Quietprinter/Model 5201	1,676.00
Auto Sheet Feed	421.00
Form Feed	90.00
TEC F-10 Printer (55 cps)	1,330.00
SilverReed Exp 770 (36 cps)	1,100.00
SilverReed Exp 770 Single Cut Sheet Feeder	210.00
SilverReed Exp 770 Dual Cut Sheet Feeder	250.00
NEC 3550 Spinwriter	1,700.00
NEC 3550 Cut Sheet Feeder	700.00
NEC 3550 Dual Bin Cut Sheet Feeder	850.00
NEC 3550 Envelope Adaptor (Add on to cut sheet feeder)	190.00
NEC 3550 Bi-directional Form Tractor	210.00
NEC 7730 Spinwriter	2,380.00
NEC 7730 Cut Sheet Feeder	1,200.00
HP 7470A 2 Pens Plotter	1,450.00
HP 7475A 6 Pens Plotter	2,500.00
MONITOR	
Amdek Monitor 310	300.00
Amdek Monitor 300 (Use with color graphics adaptor)	200.00
MULTIFUNCTION CARD	
Sigma Maximiser	385.00
Quadboard/64K	415.00
AST-Six Pak Plus	415.00
MODEM	
Hayes Smart Modem 1200 (External)	net 720.00
Hayes Smart Modem 1200B/Smartcom II (Internal)	net 695.00
Prism Modem	HK$ 2,500.00

			Price (US$)
LOCAL AREA NETWORK			
PC Net Starter Kit			1,200.00
PC Net Adaptor Card			550.00
Netware/G Starter Kit			3,040.00
Netware/G Interface Cards			763.00
Netware/G-20 System			8,890.00
Netware/G-45 System			10,620.00
Netware/S-20 System			14,140.00
Netware/S-45 System			15,890.00
Netware/S-76 System			19,450.00
Netware/S Interface Cards			275.00
HARD DISK / TAPE BACK UP UNIT			
Ampex PCM-113 10MB Hard Disk			2,380.00
Ampex PCM-127 20MB Hard Disk			3,000.00
Ampex PCM-227 20MB Hard Disk + 28MB Tape Back Up			5,380.00
Ampex PCM-325 28MB Tape Back Up Unit			2,380.00
Sysgen XL 20MB Combo			3,625.00
Sysgen XL 40MB Combo			4,925.00
Sysgen Image (10MB Cassette Back Up)			1,095.00
Sysgen Qic-File (45MB Internal)			1,595.00
Sysgen Qic-File (45MB External)			1,645.00
OTHERS			
Quadlink			580.00
IRMA			1,250.00
IBM PC Supervision Card with Graphic Adaptor Option			1,560.00
Hercules Graphics Cards			550.00
Echo PC			315.00
Chinese Character Adaptor/M2025		net	250.00
PC Scanner Model 240 (With High Resolution Pen and Print Program)			1,120.00
Penpad 320			1,700.00
Polaroid Palette			1,800.00
AST-3780	3780 Bisync		965.00
AST-SNA	3270 SDLC		915.00
AST-5251 (Remote)	5251 Emu		915.00

SUPPLIES	Price (US$)
HP Laser Jet Toner 3000 pages	100.00
HP 4 Colour Pens	12.00
TEC F-10 Ribbon	10.00
NEC 3550/7730 Ribbon	12.00
NEC P3 Ribbon	12.00
Toshiba P1350 Ribbon	HK$ 80.00
FX-80 Ribbon	HK$ 70.00
Epson FX-105 Ribbon	HK$ 200.00
Epson LQ-1500 Ribbon	HK$ 80.00
IBM Blank Diskette 1D	HK$ 195.00
IBM Blank Diskette 2D	HK$ 330.00
IBM Blank Diskette 2HD	HK$ 360.00
DC 600A Tape	HK$ 468.00
Sysgen Image Cassette	HK$ 585.00

DODWELL PERSONAL COMPUTER STORE
Shop L/G 47, Silvercord,
ASIA COMPUTER PLAZA
30 Canton Road,
Kowloon
Tel : 3-688437

Head Office : 3/F. Elizabeth House,
Causeway Bay,
Hong Kong
5-8316333

86.

November 19, 1985

IBM PC PRICE LIST

SOFTWARE

Category	Item No.	Description	Price (US$)
Business	6024026	General Accounting by BPI	489.00
	6024027	Accounts Receivable by BPI	489.00
	6024028	Payroll by BPI	489.00
	6024029	Job Cost System by BPI	633.00
	6024030	Inventory Control by BPI	489.00
	6024056	Accounts Receivable by Peachtree V1.1	685.00
	6024057	Inventory Control by Peachtree V1.1	685.00
	6024058	General Ledger Peachtree V1.1	685.00
	6024059	Accounts Payable by Peachtree V1.1	685.00
	6024060	Payroll Accounting by Peachtree V1.1	685.00
Educational	6024013	Typing Tutor	29.00
	6024023	Fact Track	104.00
	6024024	Arithmetic Games Set 1	69.00
	6024025	Arithmetic Games Set 2	69.00
	6024053	Basic Primer	69.00
	6024068	Learning Dos 2.0	35.00
	6024070	Multiplication Tables	58.00
	6024080	Learning to use Dos 2.0	15.00
	6024081	Learning to Program in Basic	41.00
	1502461	Karel The Robot - Textbook	52.00
Entertain-ment	6024006	Adventure	35.00
	6024020	Decathlon	41.00
	6024038	Adventure in Serenia	41.00
	6024054	Casino Games	41.00
	6024055	Strategy Games	35.00
	6024064	101 Monochrome Mazes	41.00
	6024093	King's Quest	58.00
	6024097	Gertrude's Secret	52.00
	6024098	Gertrude's Puzzles	52.00
	6024099	Rocky's Boots	58.00
Language	6024002	DOS Macro Assembler	202.00
	6024003	DOS Basic Compiler	345.00
	6024010	DOS Pascal	345.00
	6024011	DOS Cobol	805.00
	6024012	DOS Fortran	403.00
	6024033	UCSD PASCAL Compiler Alone	202.00
	6024034	FORTRAN-77 Compiler Alone	202.00
	6024046	Basic Program Development System	150.00
	6024062	File Command	41.00
	6024076	Logo	202.00
	6024077	IBM PC APL	225.00
	6024200	Professional Fortran	685.00
	6024003	Xenix Software Development System	524.00

APPENDIX E: (continue ...)

Operating System	6024016	UCSD P-System with PASCAL	719.00
	6024017	UCSD P-System with FORTRAN-77	719.00
	6024035	CP/M-86 Operating System	276.00
	6024040	UCSD P-System Runtime Support	58.00
	6024141	DOS 2.1 (A/FE)	75.00
	6936836	DOS 2.0 (A/FE)	69.00
	6936936	DOS 1.1 (A/FE)	46.00
	6024190	DOS 3.0	75.00
	6024211	DOS 3.1	75.00
	6024607	XENIX Operating System	455.00
Communication	6024032	Asyn Comm. Support V2.0	69.00
	6024036	SNA 3270 Emulation Program	805.00
	6024037	BSC 3270 Emulation Program	805.00
	6024195	PC Network Program	87.00
	6024042	3101 Emulation Program	161.00
	6024047	Home Budget Program	69.00
	6024107	Cluster Program	106.00
	6024182	Cluster 5 Pack	460.00
	6024187	PC Displaycomm BSC	432.00
	6092651	5250 Emulation Program V1.0	189.00
	6092651	5520 Emulation Program V2.0	327.00
	6113551	5520 Emulation Program V1.0	189.00
	6293576	5218 Printer Driver Program	202.00
	6322526	PC Network SNA 3270 EMU. PRG.	432.00
Professional	6024004	Visicalc	230.00
	6024019	Time Manager	115.00
	6024208	XENIX Text Formatting System	167.00
	6403731	Displaywriter/PC Attach Program	345.00
	6024022	Multiplan	288.00
	6024041	PFS-File	161.00
	6024045	PFS-Report	144.00
	6024048	Professional Editor	150.00
	6024131	Topview	172.00
	6024133	Topview Programmer's Toolkit	455.00
	6024143	Professional Debug Facility	173.00
	6024049	Mailing List Manager	225.00
	6024050	Diskette Libararian	52.00
	6024051	Personal Editor	115.00
	6024144	Writing Assistant WP	172.00
	6024145	Filing Assistant FILING	172.00
	6024146	Reporting Assistant	149.00
	6024147	Graphing Assistant	172.00
	6024150	Assistant Home Solutions	69.00
	6024151	Assistant Executive Solutions	69.00
	6024152	Assistant Accounting Solutions	92.00

Word Processing	6024005	EasyWriter V1.1	292.00
	6024039	PeachText	460.00
	6024071	Wordproof	69.00
	6024179	PC Writer	229.00
	6024188	Displaywrite 1	110.00
	6024189	Displaywrite 2	344.00
		Displaywrite 3	402.00
	6024190	Displaywrite Legal Dictionary	190.00
Manual	6113539	Maintenance Manual 5250/5520	10.00
	6936830	Guide To Operation Manual XT	58.00
	6936832	Technical Reference Manual XT	61.00
	6936834	Hardware Maintenance Manual XT	179.00
	6936869	Guide To Operation Manual	55.00
	6936890	Hardware Maintenance Manual	171.00
	6936895	Technical Reference Manual	35.00
	6936909	Basic Reference Manual	44.00
	1502241	PCAT Guide To Operation Manual	57.00
	1502242	PCAT Hardware Main. & Service Manual	339.00
	1502243	PCAT Technical Reference Manual	35.00
	1502491	PCAT Installation & Setup Manual	46.00
	6024125	DOS 2.1 Technical Reference	35.00
	6024181	DOS 3.0 Technical Reference	46.00
	6113539	5250/5520 Maintenance Manual	10.00
	6138518	Xenix General Information Manual	2.00
	6322505	PC Network Technical Reference	224.00

APPENDIX E: (continue ...)

NON IBM LOGO SOFTWARE

	US$
Wordstar Professional (Wordstar, Mailmerge, Correct-Star, StarIndex)	764.50
Wordstar 2000	550.00
Wordstar 2000+	640.00
Wordstar	544.50
Spellstar	165.00
Mailmerge	275.00
Multimate	544.50
Easywriter II	400.00
Microsoft Word with Mouse	510.00
Symphony	764.50
Framework	729.50
dBASE II	519.00
dBASE III	729.50
Lotus 1-2-3	544.50
Crosstalk	225.00
Sideway	66.00
Vterm	250.00
OMICRON Accounting Package (Per Module)	1,065.00
Multicurrency Accounting Package (MCAP)	10,000.00
* Peachtext 5000	450.00
* SuperCalc II	324.50
* SuperCalc III	434.50
* DBmaster	640.00
* Visidex-visindex	350.00
* Visifile	430.00
* Easyfiler	550.00
* Statpac	430.00
* Jack II	560.00
* Visischedule	350.00
* VisiTrend/Plot	360.00
* Harvard Total Project Manager	450.00
* Engineering & Scientific Programs for IBM PC	13.00

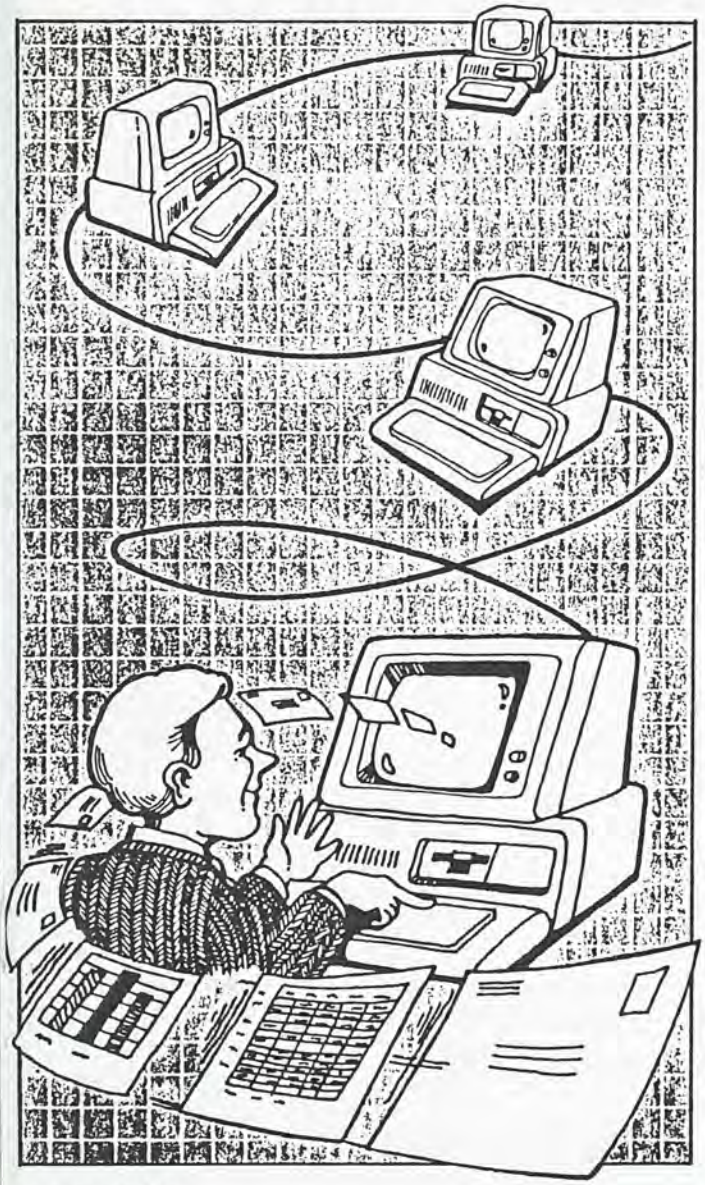
Tools and Utilities

	US$
McGrawHill Interactive Authoring System	2,200.00
ATI Training Package (Per Module)	110.00
PC Tutor 1.1/2.0	69.00
Home Accountant	214.50
Flight Simulator	71.00
Introduction PC Set	71.00
Prokey	110.00
Executive Suite	56.00
Norton Utilities 2.0	110.00
Energraphics with Plotter Option	550.00
Cdex Training on DOS	106.00
Cdex Training on Lotus 1-2-3	106.00
Btrieve	360.00

* No Training Class is to be provided

3Com EtherSeries

Local Network Communication for IBM PC/XTs



The demand of communication between computers is exploding. Personal computers have become widely accepted by their users, like you, are looking for ways to further increase their productivity and save themselves money. EtherSeries provide a way to do both.

Ethernet, has been widely adopted by computer companies as a network standard. 3Com has made it even better with hardware and software packages that make up EtherSeries for your IBM-PC and XTs.

The EtherLink Controller Card, complies with all IEEE-802. 3 specification set by the world wide standards organization, the Institute of Electrical and Electronic Engineers. With EtherLink, hundreds of computers can be connected over hundreds to thousands meters at the speed of 10 million bits per second. Not only you can link your IBM-PCs together but also DEC PDPs, DEC VAXs, Intel, Altos computers as well as many other machines to suit your expansion needs.

With EtherShare software packages, mass storage devices such as the harddisk in your XT and the SUNOL* drives, can be shared by all computers in the network, users can access files and records in another workstation with file protection. Since EtherShare can be working at the background, your computer is free for you even its files are being shared by other user.

With EtherPrint, you can assign the central printer as your local printing device without changing your application software, for example, you may just type Ctrl-P then information displays on your video monitor would also be sent to the central printer.

Off-the-shelf Ethernet version software packages for Electronic Mail, Accounting, Inventory Control, Sales and Purchase Order Processing, VisiWord* word processor, electronic spreadsheet programs such as VisiCalc*, data base management systems like DBASE2*, DataStore*, are available NOW, thus you don't have to worry about software support. In fact, EtherSeries is compatible with almost all application software in the market for your IBM-PC.

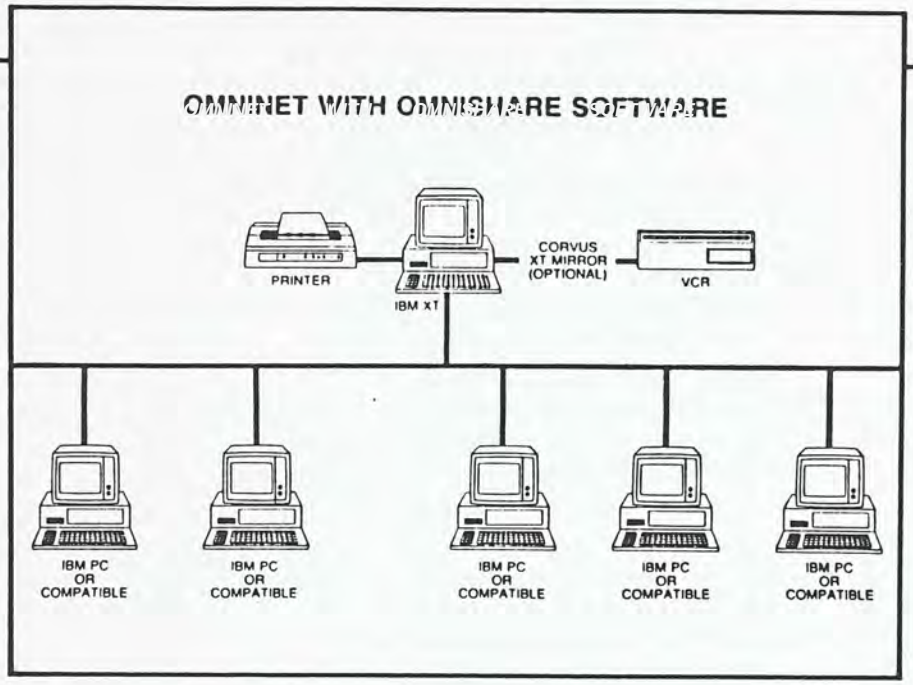
To learn more, contact your networking specialist;

Convergent Microsystems (H.K.) Ltd. at (3) 636387

Distributed by

Convergent Microsystems (H.K.) LTD.
Unit 1111, Tower A, Hung Hom Commercial Centre,
39 Matauwei Road, Kowloon, Hong Kong.
Tel.: (3) 636387 Telex: 51547 CVGMS

OmniShare



OmniShare,™ Your Low-Cost Introduction to OMNINET™ . . .

LET YOUR IBM PCs AND XT COOPERATE

Now there's a low-cost way for the IBM XT and an office of PCs and PC-compatibles to share each other's information, from the makers of the leading local area network for microcomputers. OmniShare™, the new network software from Corvus. It gives you the full value of your IBM XT and PCs—and the advantages of OMNINET™.

OmniShare lets the XT fixed disk act just like a Corvus disk system so IBM PC and XT users can share each other's information and the mass storage of a single XT—simply, affordably.

OmniShare introduces you to the family of reliable Corvus products. You get these advantages of an OMNINET local area network:

- The lowest-cost local area network for microcomputers
- Speed and reliability
- Safe, secure management of network information
- Easy upgrade to OmniDrive™ for virtually unlimited mass storage
- Low-cost backup with the XT MIRROR®, Network MIRROR™ or The Bank™

OmniShare is the easiest network to install and use. A Transporter™ card plus network software, OmniShare is your low-cost introduction to the cost-savings and reliability of OMNINET.

CUT YOUR COMPUTING COSTS . . .

OmniShare cuts your computing costs by letting you share peripherals like printers, plotters and fixed disk storage—at a fraction of the cost of adding a hard disk or printer at each station. Because you can do your work more easily, OmniShare saves you time and money.

CORVUS

Corvus Systems, Inc.
2100 Corvus Drive
San Jose, California 95124
(408) 559-7000
Telex 278976

CORVUS OMNISHARE

. . . AND INCREASE YOUR EFFICIENCY---SAFELY

Typically, two to five PCs share one XT's fixed disk on a network. Sharing is quick: The network transfers information at the rate of 1 million bits a second.

Sharing mass storage is safe. OmniShare features network management that controls access to information. OmniShare gives you password protection, file management, spooling, volume lock-out, flexible volume definition--and data security.

CREATING A NETWORK IS EASY

OmniShare is as easy to use as it is to install. Plug the Corvus Transporter™ card into each computer and attach the tap cable to the network.

Insert the OmniShare floppy diskettes. Answer a few simple questions and the software copies automatically. Your network is ready to run.

It's easy to add an OmniDrive™ Winchester network disk system when you want to expand your OMNINET network. OmniDrive, with up to 45 megabytes of storage per drive, connects directly to the network. Multiply that storage by adding another OmniDrive. Or another.

Once you've copied the information from the XT drive to OmniDrive, you'll have increased performance and almost unlimited mass storage. And you'll have the added ability to mix brands of micros on the network.

JOIN THE CORVUS NETWORK PRODUCT FAMILY

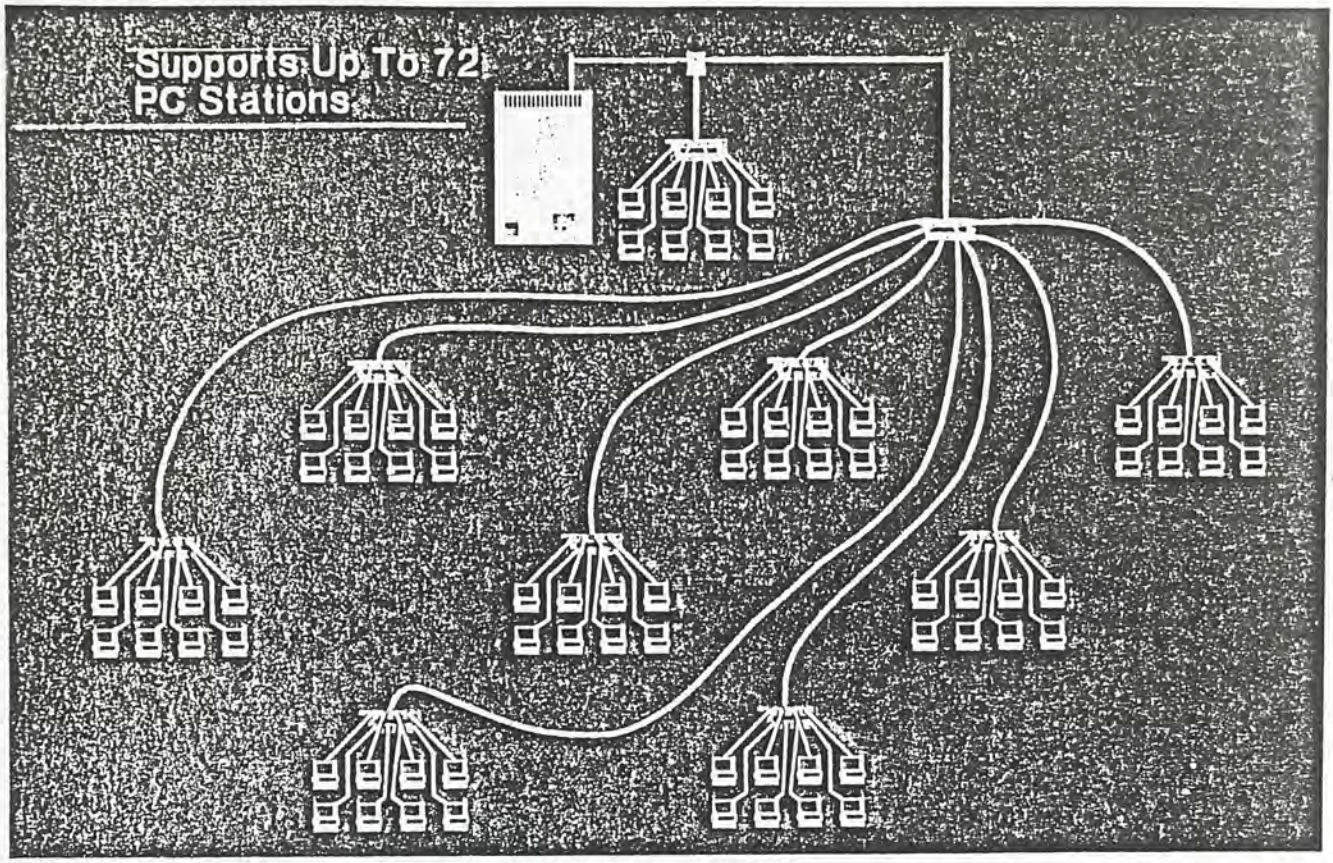
Discover the family of reliable network products from Corvus. The Bank™ backs up the shared portions of the XT drive and stores a library of information on removable, 100- or 200-megabyte tape cartridges.

Or safeguard your information by storing it on ordinary videotape with the proven technology of the XT MIRROR® or Network MIRROR™ back-up systems. Use the Corvus Printer Server to let a network of PCs share up to three printers.

Introduce yourself to the advantages of letting your PCs and XT cooperate. Contact your local Corvus representative today.

Publication No. 1002

IBM Personal Computer Network



- The IBM Personal Computer Network is a low-cost, high-function broadband Local Area Network (LAN) for the family of IBM Personal Computers.
- Using advanced technology, it can provide a highly reliable, low maintenance network, using standard coaxial cable and connection hardware.
- It can support up to 72 nodes, with extensions of up to 1,000 nodes possible through customised installation.
- It can provide comprehensive resource sharing of files, printers, data and programs, plus a sophisticated messaging system.
- Any workstation on an IBM Personal Computer Network can be a server.
- The IBM Personal Computer Network product comprises an Intelligent Adapter Card, a Network Translator Unit, cabling options and IBM Personal Computer Network software.
- It can support the IBM Personal Computer, the IBM Portable Personal Computer, the IBM Personal Computer XT, and the IBM Personal Computer AT running the IBM Personal Computer Disk Operating System (DOS) 3.1.
- The maximum cable run of an IBM Personal Computer Network is 304.8 m/1,000ft from the Network Translator Unit: with customised installation, this can be extended up to 5 km/3.1 miles.
- Customer Set-up.

IBM

The IBM Personal Computer Network is a low-cost, high-function customer-installable broadband Local Area Network (LAN) which uses standard coaxial cabling. It can provide an IBM Personal Computer networking solution for departments, or single-site locations.

Customers can install a small system of up to 8 workstations and grow, over time, up to 72 workstations, as requirements dictate, utilising the components of their initial investment.

The IBM Personal Computer Network has been designed to be compatible with current applications; it has also been designed so that users are protected from the impact of changes and upgrades except, of course, that it allows new functions and capabilities to be added.

An IBM Personal Computer Network can provide resource sharing for users on the network: this includes file sharing, printer sharing, and program sharing*. Any workstation with a hard disk on the network can be a server station and can support up to 32 concurrent user IDs.

In addition, an IBM Personal Computer Network can provide electronic mail facilities for messaging and file transfer. When using the system for message management, a single workstation can provide support for 12 user IDs.

Customers requiring a larger network may consult a suitably-qualified cabling contractor to supplement the basic IBM Personal Computer Network with additional cabling for up to 255 workstations and to provide an enhanced translator unit allowing a further potential increase up to 1,000.

*Please refer to the section 'Use of IBM Personal Computer software' below.

Expanding the Network

Not only can the system be expanded by the addition of workstations, but further functions and applications can be implemented as appropriate. For example, with suitable programming, record locking can be implemented: this could be a useful productivity enhancement to the file blocking capability provided. Program-to-program applications can also be developed.

Furthermore, as the IBM Personal Computer Network uses broadband technology, non-coded applications, such as voice or video transmission, may be developed by third parties. Examples of such applications include: closed circuit TV, security access/control, fire alarm, and video conferencing.

Installing an IBM Personal Computer Network

A person with some experience should oversee the hardware and software installation. To help you design and operate your network, IBM provides:

- Instructions to guide you through the installation and maintenance procedures
- Menu-driven programs to assist you with initial set-up, and everyday use and maintenance of the network.

Once your network is operational, people already familiar with operating IBM Personal Computers should find it a simple step to operate them in the IBM Personal Computer Network environment.

Hardware

- IBM Personal Computer Network Adapter card, including 3 m/9.8 ft cable, for the IBM Personal Computer, the IBM Personal Computer XT, the IBM Portable Personal Computer and the IBM Personal Computer AT
- Fixed-frequency Translator Unit and connection hardware, 8-way splitter and cables
  - Short Distance Kit
  - Medium Distance Kit
  - Long Distance Kit
  - 25, 50, 100, 200 foot cables

Software

- The IBM Personal Computer Network program includes one of each of the following:
  - o Program diskette
  - o Program manual
  - o 'Program Application Guide to Setup' manual
  - o 'Exploring the IBM Personal Computer Network' diskette
- IBM Personal Computers on the network require the IBM Personal Computer Disk Operating System (DOS) 3.1.

Technical description

Topology	Tree
Transmission technique	Broadband
Data transmission rate	2M bits per second
Access protocol	CSMA/CD
Medium	75 ohm coaxial cable CATV-compatible
Maximum number of nodes	72
Maximum distance from Translator Unit	304.8 m (1,000 ft)
Maximum distance between two nodes	609.6 m (2,000 ft)
Interface	Intelligent adapter card
Additional growth via customised solution	Additional nodes, greater distances, multiple services

- Minimum system requirements:
  For full details please contact your Authorized IBM Personal Computer Dealers.

Ordering procedures

The IBM Personal Computer Network is available under the Authorized IBM Personal Computer Dealers. Customers wishing to install between 72 and 255 nodes will need to order specially-designed cabling from a suitably qualified cabling contractor. For an installation of between 255 and 1000 nodes, customers will also need to order a suitable translator unit.

Use of IBM Personal Computer software

The terms and conditions under which the customer acquires software for the IBM Personal Computer from IBM permit the use of a program on a single machine. The customer is responsible for ensuring that each user on the network is appropriately licensed to use any programs shared over the network.

Authorized Dealer
Personal Computers

IBM Authorized Dealers

ARA OFFICE AUTOMATION CO., LIMITED
B504 Watson's Estate, Watson Road, Hong Kong. Tel: 5-728611
Showroom: Asia Computer Plaza, C018, Silvercord, 30 Canton Road, TST, Kowloon.

COMPUTERLAND U.S.A.
15/F., Unistock Finance Building, 131 Gloucester Road, Hong Kong
G/F., Unistock Finance Building, 131 Gloucester Road, Hong Kong. Tel: 5-739928

DODWELL COMPUTER DIVISION
B47, 1st Basement, The Landmark, Hong Kong. Tel: 5-265977
3/F., Elizabeth House, 250 Gloucester Road, Hong Kong. Tel: 5-8116550
Shop 1A 047, Silvercord, Asia Computer Plaza, 30 Canton Road, Kowloon. Tel: 3-668437

SYSTEM-PRO
BUSINESS COMPUTER SOLUTIONS LTD.
17/F., Bank of East Asia Building, 10 Des Voeux Road, C., Hong Kong. Tel: 5-263006
22b The Landmark, 11 Pedder Street, Hong Kong
538 Ocean Centre, Canton Road, Kowloon